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UNITED STATES DEPARTMENT OF AGRICULTURE

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Washington, D. C. ▼ November, 1926

FACTORS AFFECTING THE PRICE OF HOGS

By

G. C. HAAS and MORDECAI EZEKIEL, Agricultural Economists
Bureau of Agricultural Economics

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By G. C. Haas and Mordecai Ezekiel, *Agricultural Economists, Bureau of Agricultural Economics*[1]

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WAYS IN WHICH FARMERS ADJUST OPERATIONS TO HOG PRICES

The 5,000,000 hog producers of this country use hog prices as an indication of when to increase their production and when to decrease, just as producers of all other commodities sold on a competitive market use prices as a guide to their operations.

Though all producers consciously or unconsciously take price into consideration (fig. 1) the decisions they reach vary with the individual. Farmers may be grouped roughly into three classes in this regard: (1) Those who expand production when prices are favorable and contract when prices are unfavorable; (2) those who look beyond current prices to the future, and hence generally do just the reverse; and (3) those who keep practically uniform production regardless of price.

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[1] The analysis on which this bulletin is based was initiated by the senior author in 1923, in an effort to arrive at means of forecasting hog prices. He worked out the forecasting technique described in the section on "Forecasting prices in deviations from trend" and then cooperated with the junior author in the study of the way farmers could use these results and in a joint study of the fundamental economic relations of factors affecting hog prices. After January 1, 1925, the study of the economics of the market and the further study of forecasting prices by the percentage-change method were completed by the junior author and the text of this bulletin was written by him.

Assistance on the statistical phases of the work was rendered by Margaret Matheson and Anna R. Sullivan and appreciation is due them for their share in this investigation.

A popular discussion of the material presented in this bulletin is given in the U. S. Dept. Agr. Farmers' Bul., "What Makes the Price of Hogs?" *(8)*[2]

[2] Figures in parenthesis in italic refer to "Literature cited," p. 67.

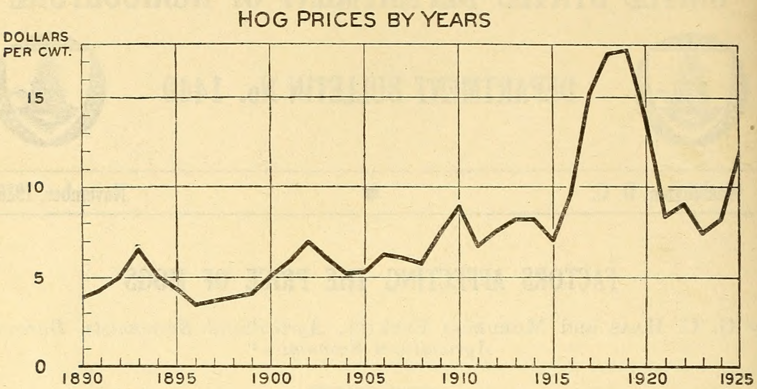

FIG. 1.—Average yearly price of heavy hogs at Chicago, 1890 to 1925. Though there has been a steady upward trend in price, individual years show wide deviations

The records of three farmers in Indiana, shown in Figure 2, illustrate these three ways of adjustment.

The first farmer changed his breeding herd from year to year, in response to future prices. One year he fed out three times as many hogs as he did another year. In five of the seven years shown, he had more hogs to sell when prices were high compared with corn, or fewer to sell when prices were low compared with corn.

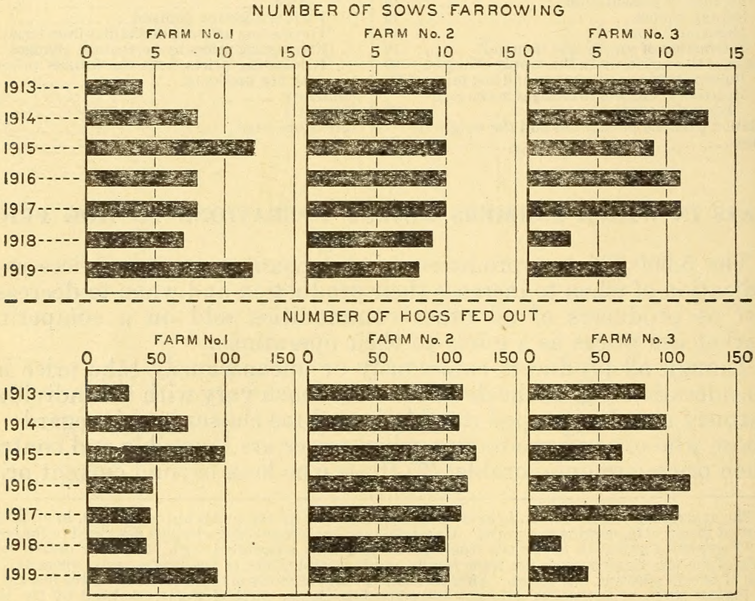

FIG. 2.—Changes in the hog enterprise on three Indiana farms. Farmer 2 maintained a steady production; farmer 1 guessed prices right most of the time; farmer 3 usually guessed wrong

The second farmer kept about the same number of sows each year and fed out about the same number of hogs. He carried over good supplies of corn from the years of heavy crops, and bought corn when necessary.

The third farmer changed his production from year to year in response to current and past price relations. Generally the years when he reduced his number of hogs were the years when the first farmer increased his. Five years out of seven the third farmer had fewer hogs to sell when hogs were high in price, and many to sell when hogs were cheap. Most hog farmers vary their hog production in much the same way that this third farmer did. They decide what to do on the basis of the current or past prices, paying no attention to the way such conditions have worked out in previous years.[3]

It is evident that the first farmer, in terms of individual profit, was producing more effectively than either of the others. Fuller comprehension of what are the factors affecting hog prices should enable farmers to make a more rational control of their production, instead of changing, as so many of them do, blindly, and usually at the wrong time.

Ultimate value of full knowledge and understanding of the circumstances and forces from which prices arise does not lie, however, in merely aiding some few individual producers to outguess the mass of farmers and so secure individual gains. As more and more men come to base their actions not on what current prices *are*, but on what current prices *mean*, production as a whole will be more and more smoothly coordinated with what it should be to give the largest net income to both producers and consumers. As a result, much of the wastes which now ensue when either too large or too small a proportion of economic resources are devoted to hog production will be prevented, and the hog industry, in common with similar developments in other industries, will do its part in affording a constantly increasing level of general well-being.

PREVIOUS STUDIES OF HOG PRICES

The fact that hog prices tend to move in recurring cycles has long been recognized. Fifty years ago Benner (*1*) pointed out the regularly recurring short cycles in hog prices. He also thought there was a longer 11-year cycle. What was more remarkable for that early time, he seemed to recognize some relationship between pig-iron production and hog prices. More recently, Warren (*29, pp. 87–88; 30, pp. 7–9*) in pointing out the tendency toward a regularity in the hog-production cycle, stressed the effect of an unusual corn crop in advancing or retarding the movement.

Wallace (*28*) was apparently the first to apply exact statistical method to the analysis of hog prices. He pointed out the significance of the relation of corn prices to future hog prices, and made multiple correlation studies of the relation of supplies and business activity to hog prices (with a multiple correlation of 0.70 for the pre-war period). He did not, however, attempt to forecast supplies or prices from the corn-hog price relationship as such.

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[3] These illustrations are available through the courtesy of H. W. Hawthorne. A full description of the area and type of farming they represent is given in reference (*15*). All of the difference in income on these three farms should not be ascribed to the differences shown in the management of the hog enterprise, as there are many other things in farm operation in this area which play an important part in affecting farm returns.

Warren and Pearson (*31, pp. 133–149*) pointed out how hog production followed changes in the corn-hog ratio, and stated that it was probably the dominant element causing hog-price changes.

Wright, using data of practically semiannual averages, worked out mathematically the effect of this relation upon subsequent receipts and prices, and gave what was apparently the first clear explanation of the causes of the fairly regular recurrence of the hog cycle (*34, p. 59*). While showing that regression equations involving corn prices and the summer weight of hogs would give good correlation with the receipts and prices of hogs for the next winter, he did not include the corn-hog ratio as such in his correlations, and hence did not measure the significance of this relation directly. Sarle (*20*) showed that the direct use of the corn-hog ratio as a factor would improve the accuracy with which hog prices could be forecasted. Certain details of his statistical treatment however, prevented him from obtaining the full measure of its true importance (*7*).

Several investigators have pointed out the high degree of correspondence between the wholesale and retail prices of hog products and of live hogs, Wallace (*28*), Wentworth and Ellinger (*32*), and Wright (*34*) working out mathematical statements of the nature and closeness of the relation.

These successive studies have marked an advance in the understanding of the subject, and a closer approach to a complete explanation of all the factors involved. The present study does not pretend to be such a complete statement but is offered merely as another step in advance.

In his first publication half a century ago, Benner said (*1, p. 131*):

> The science of price cycles is yet in the cradle of its infancy, but waiting its time to mature full development, to unfold its principles, and declare its oracles to all mankind, and to demonstrate that the causes and the laws of nature in production are not past finding out; and that man in his onward path of progress * * * will ultimately grasp the future.

Looking back over the record of the unfolding knowledge of the price-making forces for one product, and realizing the continuous improvement both in basic data and in analytical technique which has accompanied this advance, it would seem that Benner's optimism has been fully justified.

DESCRIPTION OF THE MARKET WHERE THE PRICE IS MADE

Approximately 70 per cent of the hogs produced on our nearly 5,000,000 hog-producing farms are slaughtered and converted into meat and meat products by packing establishments. Nearly 1,400 individual establishments were engaged in this business in 1923, but the bulk of the business was done by less than a dozen large corporations, operating plants at many different points. From these plants the meat is distributed to retail dealers largely through a system of branch houses, wholesale salesmen, and refrigerator-car routes operated under the same business management as the packing establishments. Something like 100,000 retail dealers in fresh meats, as well as many groceries, delicatessens, and other retail establishments handling cured meats, complete the final step in distribution to the consumer.[4]

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[4] According to Marshall (*16*), based on scattered surveys, in cities outside of New York City there is one retail store handling fresh meats for about every 800 persons; in New York City, one for about every 1,450 (excluding kosher stores), and in rural communities except in the South, one for about every 1,700. Retail meat stores are rare in rural communities in the South. The rough estimate of 100,000 retail meat stores is based upon these figures.

Although a considerable proportion of the hog products of this country are exported, notably lard, the domestic consumption is by far the largest, and therefore must be given first consideration in any study of hog prices.

Because of the way in which the packers have developed an integrated manufacturing and marketing structure which handles the product all the way from the place where the live hogs are bought in the central markets to where the dressed products are sold to retailers in the city, there are but three points in the whole of the typical marketing process at which ownership in the commodity is transferred and a price is established.

The first major point is at the central wholesale market. Even though many farmers sell to local buyers who in turn ship to market, more than half the shipments are made either through cooperative shipping associations or direct on producer's account. At the central stockyards, commission merchants sell the live animals to buyers representing local packers, out-of-town packers, feeders, speculators, etc. Most of the commission men conduct private businesses, but cooperative farmers' organizations in many cases perform this service and they now handle a very substantial proportion of the business at several markets.

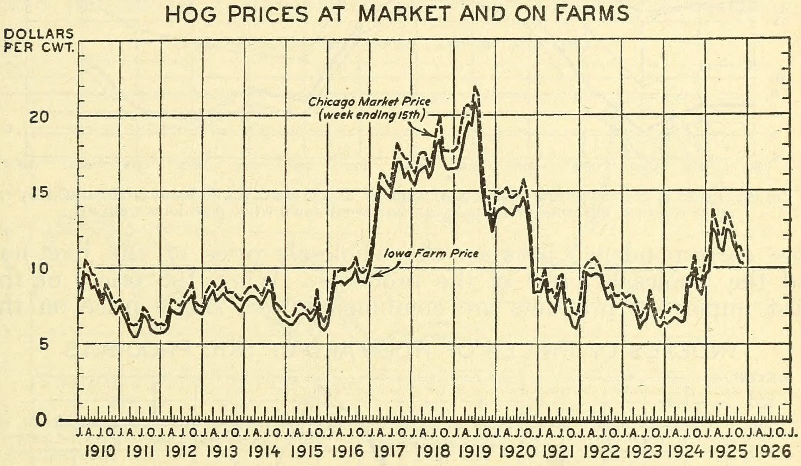

FIG. 3.—Hog prices at Chicago and at Iowa country markets for the middle of each month. Farm and wholesale prices move together closely, with practically no lag

Many animals were shipped direct from local buyers or concentration points to the packers, but the great bulk of the hogs during recent years have moved through the central markets and were sold by the commission men to the buyers. It is at this stage that the wholesale price of live hogs is really registered, there being, of course, different prices for different lots of hogs, dependent on sex, age, weight, condition, etc. As shown in Figure 3 the price paid for hogs by buyers at the farm followed closely these wholesale market prices.

The next point at which a price is registered is ordinarily when the dressed pork, cured ham or bacon, or rendered lard is sold to the jobber or retailer by the city branch house. Here each individual product is sold as a separate commodity and the prices are recorded as quotations for a considerable variety of products, cuts, and grades. Even though the prices of these different products do not always move together, yet, as is shown in Figure 4, there is in general a close correspondence between the wholesale price of the live hog and the wholesale price of the products. When the prices of the most important products are combined into a single price on the basis of the proportion of the whole carcass which they represent, this composite price varies closely with the wholesale price for hogs.

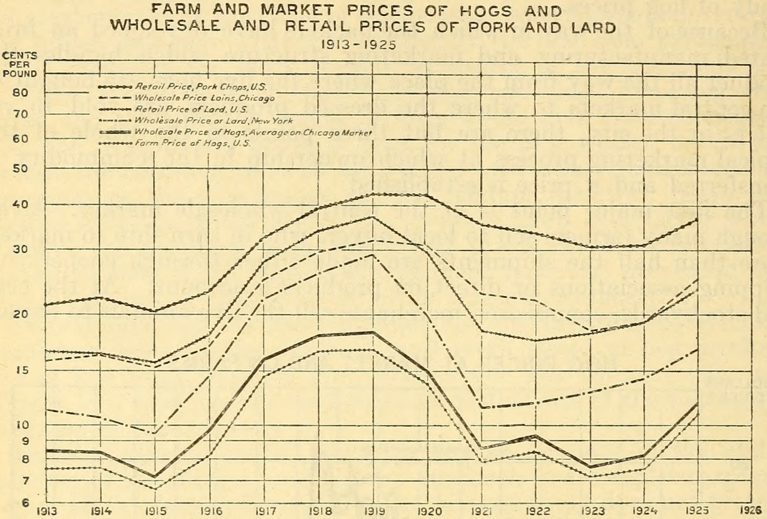

FIG. 4.—Prices at each step from farmer to consumer. The prices of the different products usually move together, but some abnormal years lard went down while pork loins went up

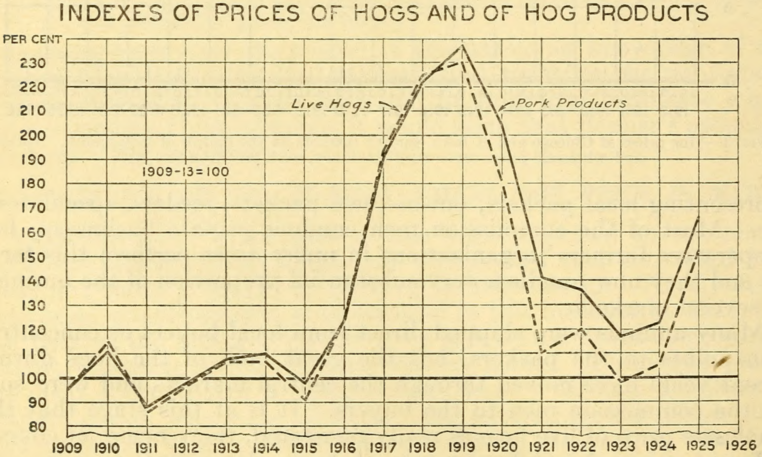

FIG. 5.—Yearly average price of heavy hogs, and an average of the price of pork products, both expressed in percentage of the averages for the period 1909 to 1913. Both have moved closely together, but since 1920 the prices of products have been about 20 per cent above the prices of hogs, compared with the pre-war relationship

Final transfer of ownership occurs when the retailer sells the product to the housewife, boarding-house keeper, or other person who prepares it for the "ultimate consumer." The prices actually paid for the same product in different stores vary widely with the class of store and the amount of service which the retailer gives; though competition between retail stores is so keen that, as between stores of the same class providing the same service, there is usually little difference in price.

What the consumer can be induced to pay for the meat he buys, is the final fact which limits the price which retailers can pay at wholesale; and the price for which the products can be sold at wholesale limits the price which packers can pay for the live hog. There is thus a general correspondence between retail prices, wholesale prices for meats, and wholesale prices for live hogs, as illustrated in Figure 4. It is true, however, that at certain periods or seasons the retail meat prices do not move with the wholesale meat prices; and, further, that as between widely separated years, there are marked differences in the relation of retail prices and wholesale prices to live-hog prices. This is especially true of the relation before the war and since the deflation period. (Fig. 5.)

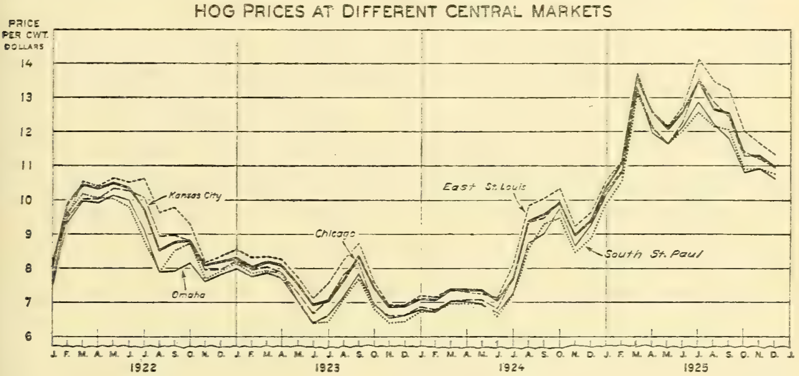

FIG. 6.—Hog prices at Chicago and four other central markets since 1922. There is but little difference between the movements at Chicago and at other markets with the exception of occasional short periods

INTERRELATION OF PRICES AT DIFFERENT CENTRAL MARKETS

It is only in large central markets that a general market price obtains. Following the prices backward from the central market to the producer, or forward to the consumer, other conditions peculiar to each local situation come into prominence, so that the structure of retail prices from one city to another, or of country market prices from one State to another, is not nearly so closely integrated as are prices at the several central livestock markets. For the analysis of the relation of basic factors which affect prices over the country as a whole, therefore, the central market price is the most significant. Hence the greater part of this bulletin is devoted to an analysis of prices at the wholesale market.

Figure 6 shows the prices for the same grade and weight of hogs at Chicago and at a number of the other larger markets. It is evident that there is but little difference in the prices at the several markets and that prices fluctuate together rather closely, with about the same difference between the markets. This is but natural, as hogs can be shipped readily for considerable distances at a cost low in comparison to their value; dealers in one market keep in constant touch with prices in other markets by wire and telephone; and the market news service by press, mail, and radio helps farmers to keep in touch with the prices at the different markets which are accessible to them.

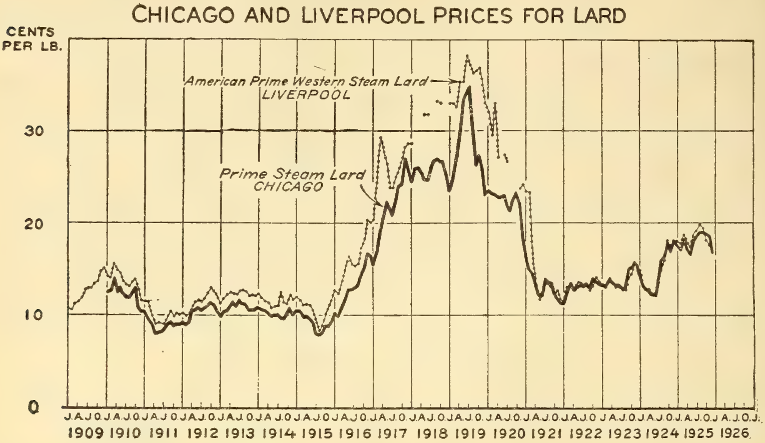

FIG. 7.—Except during the war period, lard prices have run almost exactly the same at Chicago and at Liverpool, the slight difference being due largely to the cost of transportation

Most of the differences between markets can be explained by the cost of transportation, as prices at markets in areas that produce a surplus of hogs are ordinarily somewhat below prices at markets located nearer to consuming centers. Temporary local shortages or surpluses also have some effect, however. Though there are a number of different central markets, each establishing its own price, it is

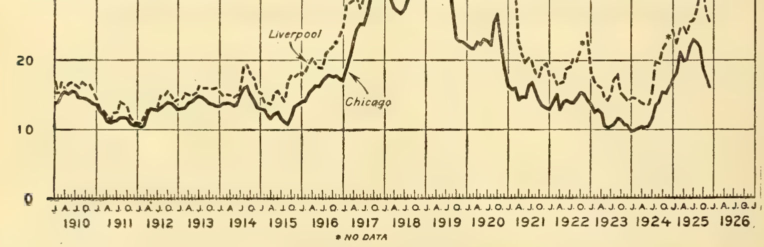

FIG. 8.—Chicago and Liverpool prices on bellies. Liverpool prices usually run about enough above Chicago prices to cover the cost of transportation, but generally follow their fluctuations very closely. The war disturbed this relation

ent that except for these very minor differences the same eco- nic conditions which determine the price at one market must termine the price at other markets. It may be said that there is ut a single central "market" for hogs in the United States. The everal central points at which prices are established are so closely interrelated that the general conditions which govern the price are the same for all the markets.

Not only do hog prices in our central markets move closely together, but they move closely with prices in foreign markets. When prices of hog products are high in Chicago they are high in Liverpool; conversely, when prices are low in Chicago they are low in Liverpool. Figures 7 and 8 show the extent to which Chicago and Liverpool prices for hog products tend to move together. These Liverpool prices serve as an indication of the price which foreign consumers are willing to pay for our meat.

The important pork-consuming section of Europe, which includes the United Kingdom, northern France, Belgium, the Netherlands, Denmark, Germany, and the southern parts of Norway and Sweden, comprises one of the principal hog-raising regions of the world. Yet since production in this region is inadequate for the requirements of the population, large quantities of our pork products move regularly to Europe, and the strength of the export demand is an important factor in our market situation at any time.

The price of hogs at Chicago, the largest central hog market in the world, may therefore be taken as an index of conditions throughout the world-wide market within which the general economic forces operate to determine prices in each market place.

PRICES USED IN THE STATISTICAL ANALYSIS

Even after the point at which the price is to be used has been decided upon, two other questions must be decided: (1) What specific price is to be used? and (2) what period of time is to be covered? Since hogs are frequently sold in lots of about the same weight but without regard to finish, the most significant differentiation in the market reports is by the weight of the hogs. The prices for heavy hogs were selected as the basis of the statistical study; however, the subsequent investigation of the relation of the prices for hogs of various weights, discussed later, indicated that prices for medium-weight hogs would have been more representative of the general changes in hog prices.

Selection of the time period to be used as the basis of quotation is possibly more significant than price. In the central market, prices may change almost every minute, and from opening to closing the change may be very great on some days. Just why prices are so variable from hour to hour and from day to day would require an extensive investigation by itself. For the first approach, however, it would seem best to disregard the more rapid variations and use only the general price average over a period of time long enough to indicate the general level.

A practical consideration in this connection is that much of the data on the subject—receipts at markets, slaughter under Federal inspection, indexes of prices, employment, and production, and other similar series—are available only as monthly items for the ea years. For this reason the calendar month was selected as the u of time to be considered and most of the analysis was made in ter of this unit, while fully appreciating that very significant pri changes might be hidden by the averaging process.

ANALYSIS OF SPECIFIC FACTORS AFFECTING THE PRICE

METHOD OF PRESENTATION

Conclusions from a statistical investigation may be presented in two ways. The first way is to give a record of the investigation, showing what hypotheses were used at each stage of the study, what relations were analyzed, and what results were obtained. Such a report is largely a chronological history of the study, with the conclusions reached interspersed through the record.

A second way is to present the conclusions reached from such portions of the investigation as gave significant results, and to give separately the statistical technique by which the results were obtained. Such presentation has the great advantage of separating the economic relations brought out from the purely statistical considerations of the method employed. The second plan has therefore been followed in this bulletin, so that county agents, students, economists, and others who are interested in the conclusions as such may be able to study them apart from the mathematical details.

SUPPLY FACTORS

The meat from the hogs which reach the markets during a given day does not all go into consumption at the same time. Some of the hogs are slaughtered immediately, some are shipped to be slaughtered at other points, and some are bought by feeders and shipped out to farms or to near-by points and fattened further before slaughtering. Even after slaughter there is great variation in the length of time before consumption. Certain cuts, such as loins, ordinarily are moved to the consumer as fresh meat, with at most a short period in the refrigerator; other cuts, such as the shoulders and spareribs, may be held under refrigeration for considerable periods; other parts are cured to ham or bacon, or are rendered into lard. Besides the time required for the curing and ripening process itself, these cured products may be held in storage almost indefinitely until a favorable time occurs for their sale. Figure 9 illustrates the way in which storage and export together smooth out the uneven seasonal slaughterings to a fairly uniform consumption throughout the year.

Since the men who are buying hogs for slaughter or other purposes must buy with regard to the probable prices for hogs and hog products for some little time ahead, the number of hogs received at the markets on any given day is not to them the most significant point in the supply situation. During recent years the general level of prices for hog products which prevailed over several months reflected the general trend of the supply over that whole period more than it reflected the supply during any single day or week.

In making bids for hogs, the buyers gave more attention to how large market receipts had been running, and how large they were expected to run during the next several months, than they did to the receipts during the single month. At the same time, they had to get their share of the business if their plants were to be kept running at a profitable volume, so during short periods when receipts temporarily fell below the general average the competition to get a share of the business forced prices somewhat above the general trend, though not nearly so much as did an equal shortage in supply extending over a considerable period.

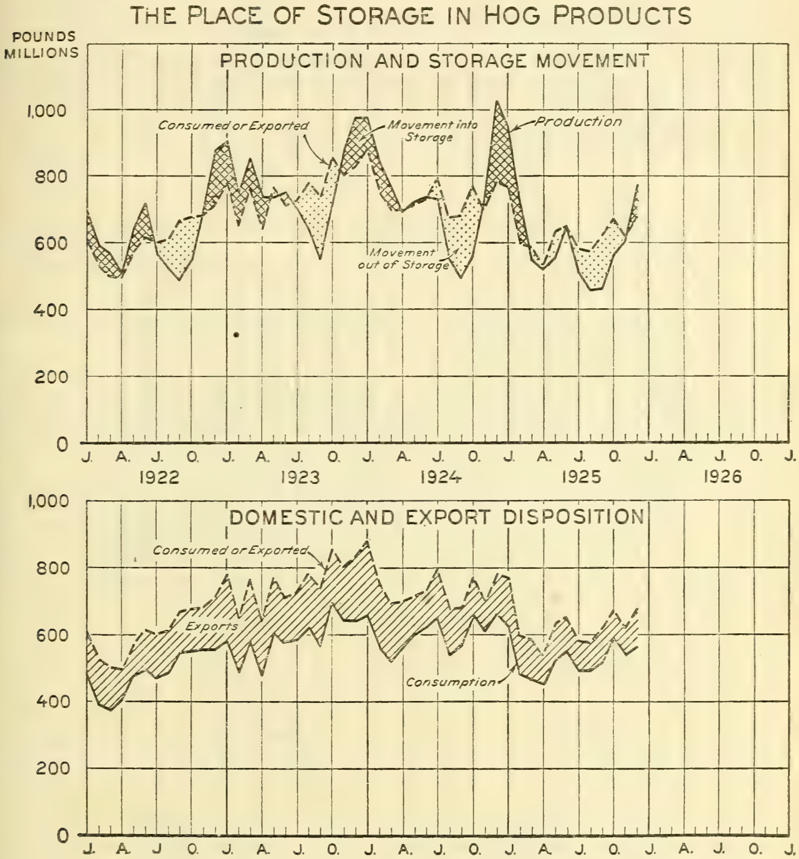

FIG. 9.—Production, storage movement, and exports of pork and pork products for four years. Storage serves to smooth out the seasonal variation in production

The number of hogs received at 11 of the largest markets each month from January, 1904, to December, 1925, is shown in Figure 10. This chart shows that ordinarily receipts were largest during the winter and smallest during the early fall, and that some years the receipts as a whole were larger than they were other years. The conditions which led farmers to make these wide differences in hog production are discussed in a later section.

The monthly averages of prices during the same period are shown in Figure 11 (basis of quotation, heavy hogs at Chicago). Comparing this chart with Figure 10 shows that there was a general tendency for the two lines to change in opposite directions, the price of hogs tending to rise when the receipts fell, and tending to fall when the receipts were larger. There were many months, however, when this was not true.

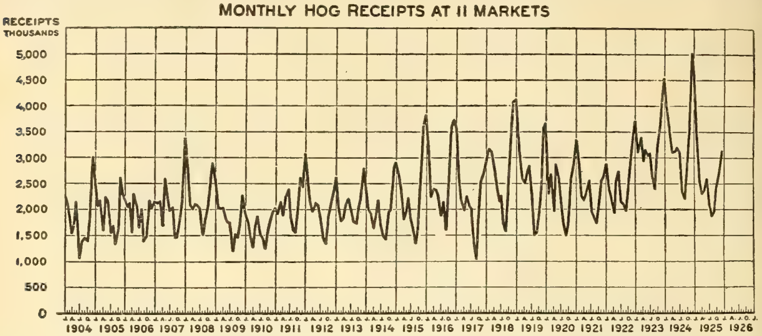

FIG. 10.—Monthly receipts of hogs at 11 markets, 1904 to 1925. Besides the seasonal variations in receipts from month to month, receipts are much heavier some years than others

During the period before the war a reduction of 10 per cent in the number of hogs marketed over a six-months period, as compared with the number marketed in other similar periods, had a tendency to raise prices, on the average, about 5 per cent; whereas an equal reduction in the number of hogs marketed during a single month, as compared with other months, tended to raise prices to a much less extent.[5] A considerable part of the change in price during this period was due to the changes in supply; but there were so many other things which affected the price for which hogs would sell that frequently the effect of the supply upon the price was covered up by price changes due to other things in the market situation. The following consideration of the demand side of the market makes clear what were some of the more important of the factors responsible for these shifts or changes in the level of demand.

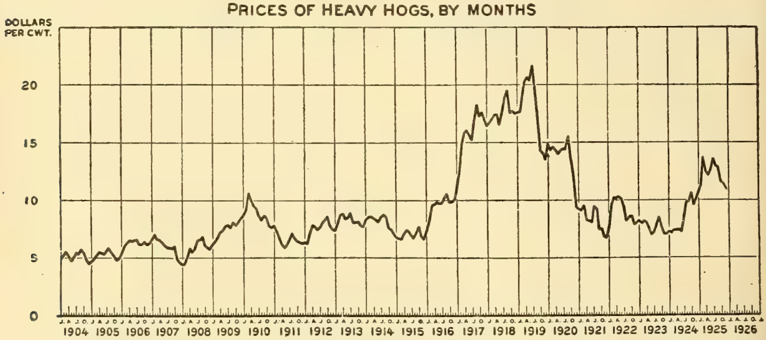

FIG. 11.—Monthly average prices of heavy hogs at Chicago, 1904 to 1925. The years when prices were lowest were years when receipts (shown in fig. 10) were highest

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[5] This conclusion is based upon the multiple correlation given on page (36), using the net regression coefficients as the measure of elasticity of demand for each factor.

DEMAND FACTORS

The demand for hogs ultimately rests upon how much meat consumers of hog products, both in this country and in Europe, are willing to buy at the prices asked. When prices for hog products drop, relatively to the prices of other products, consumers ordinarily will buy somewhat larger quantities, and when prices go up, consumers ordinarily buy somewhat less. This is the usual way by which most people readjust their purchases as the relative prices which they have to pay for different products change. But when consumers are willing to buy a larger quantity at the same price, or are willing to buy the same quantity as before at a higher price, then there has been a real increase in demand. And when such a real increase in demand does take place, its effect is speedily felt in the hog market.

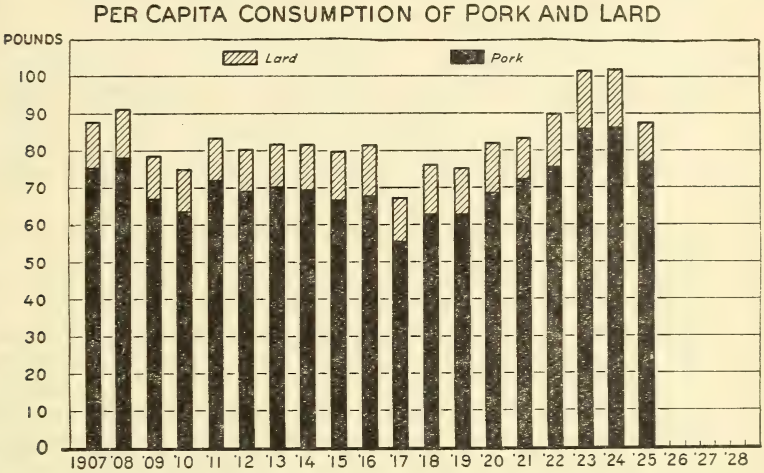
PER CAPITA CONSUMPTION OF PORK AND LARD

FIG. 12.—Annual per capita consumption of pork and lard, as estimated. There has not been any very apparent trend in consumption, either upward or downward

RELATION OF THE VALUE OF MONEY TO HOG PRICES

As indicated in Figure 11, the price of hog products rose rather steadily from 1904 to the end of the war period; yet, as shown in Figure 12, the average per capita consumption of pork and lard (as shown by the "disappearance" of meat produced under inspected slaughter) remained about the same over the period, though varying somewhat from year to year. One important reason why consumers were willing to pay constantly increasing prices during this period, without reducing their consumption, was that the money with which they made their purchases was gradually becoming more and more plentiful, and consequently of lower value or "purchasing power."

These changes in the value of money are measured with a fair degree of accuracy by using the index number of prices, which measures the average quantity of other things which can be bought for a given number of dollars. The changes in the value of money from 1904 to 1925 are shown in Figure 13, as percentages of the value in 1913.

Comparing Figure 11 with Figure 13, it is evident that much of the upward sweep of hog prices from 1904 to 1920 did not represent any real advance in the value of hogs as compared with the value of other commodities, but represented merely the lower value of money. As money decreased in value, it took more to buy the same quantity of hogs. This was especially true during the period 1916–1920. The very high prices did not mean that the value of hogs was high as compared with other commodities, but that the value of money was low.

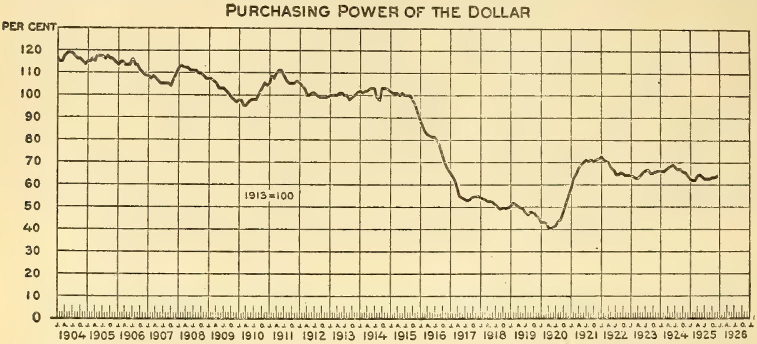

FIG. 13.—The changes in purchasing power of a dollar from 1904 to 1925 are shown by comparing the average quantity of goods which could be bought for $1 in 1913 (at wholesale prices) with the quantity of the same goods which could be bought for the same sum each month during the period. In 1924 only two-thirds as much could be bought for $1 as in 1913

When hogs sold at $18 per 100 pounds in 1919 they were not really worth much more in exchange for other goods than when they sold at $8 in 1913. This is evident when the prices are compared after multiplying each one by the index of the general purchasing power of money (fig. 13) to reduce them to dollars of equal purchasing power. Thus $18 times 49 equals $8.82, while $8 times 100 equals $8; showing that on the basis of the goods that could be bought with the money, the 1919 price was only slightly higher than the 1913 price.

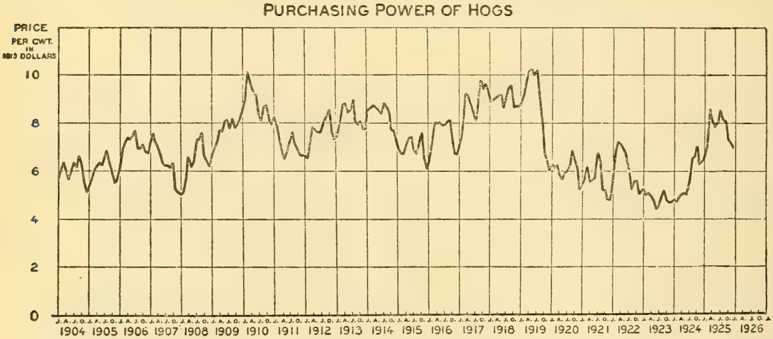

FIG. 14.—Hog prices for 22 years expressed in dollars of constant purchasing power. A great part of the total variation in prices had been due solely to changes in the value of money

Figure 14 shows the prices of hogs for the whole period reduced to dollars of constant purchasing power in this way. The comparison of this chart with Figure 11 shows that a large part of the changes in hog prices during this time was due solely to changes in the value of money.

UPWARD TREND IN DEMAND

In addition to the change in the value of money, the rapid growth in the population in this country, especially in the cities, has tended to increase the demand for hogs since 1900. During the decade from 1900 to 1910 the urban population was increasing at an average rate of more than 3.3 per cent per year; and during the following decade the increase continued at nearly the same rate. The total population in cities increased a total of more than 75 per cent during these 20 years. This increase in city population naturally increased the commercial demand for hog products.

The per capita consumption of hog products, however, so far as it could be measured, remained about the same. During the prewar period the price of hogs, even when expressed in dollars of constant purchasing power, showed an upward trend. (Fig. 14.) Since this upward trend in prices did not result in a decrease in per capita consumption, it is evident that forces were at work which made consumers willing to pay more for their products without decreasing the quantity taken.

Prices of several other farm products were also showing an upward trend during this period, even when expressed in dollars of constant purchasing power. Several of these food products take somewhat the same place in the consumer's diet as do hog products. As the price of the other products rose, consumers turned more to pork products, which tended to raise the price of pork products along with other products. During the same period that the per capita consumption of pork was being maintained, the per capita consumption of beef was tending downward, beef consumption per capita in 1913 and 1914 being one-fifth below that in 1907 and 1908. With increasing costs of both meats, consumers apparently preferred to restrict somewhat their consumption of beef and to continue to use the same quantity of pork, even though that involved paying somewhat more for the same quantity of pork per capita.

During the war period the demand situation was increasingly dominated by European conditions through the tremendously increased export demand. Following the price decline of 1920 and 1921, which terminated the highly speculative postwar expansion, prices of all farm products began gradually to work back into a realignment with the prices of other kinds of products. The prices received for hogs from 1921 to 1924 indicate that the demand for hogs (in terms of wholesale prices) is not so strong now as it was at the outbreak of the war.[6]

This decrease in demand for hogs may possibly be due in part to a somewhat smaller demand for all meats, as a result of the publicity efforts during the war to replace meats in the diet by other foods. There does seem to have been a very definite tendency toward a change in the dietary habits of American consumers during the last 10 years. The per capita consumption of fluid milk has been increasing at a remarkable rate; vegetables, especially the leafier kinds, have come into year-round use in all of the principal cities, and there have been remarkable increases in the consumption of many kinds of fruit. The general low level of the prices of other staple foods, such as wheat and potatoes, during the period from 1921 to 1923, also may have been responsible indirectly for the weaker demand for hogs.

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[6] Part of this lower wholesale demand may be due to the fact that the portion of retail meat prices retained for slaughtering, conversion, transportation, and wholesale and retail distribution has been larger from 1921 through 1925 than it was before the war, as was clearly shown in Figure 4 on page 6. For definite analysis of changes in consumer demand, studies would be required of the relation between quantities consumed and retail prices, with concurrent consideration of other factors bearing on consumers' ability or willingness to pay. The margin between retail meat prices and wholesale hog prices could also be studied to determine just where and how the changes in margin retained have occurred.

There was some recovery in the demand for hogs and hog products in 1924 and 1925, although not enough to bring demand up to its pre-war trend. Whether this recent upward movement will continue over a long period, or whether changes in dietary habits will alter its direction, can not as yet be foretold with any degree of confidence. After several years have passed, the longer series available for observation will give a much better basis for forecasting the future trend.

VARIATIONS IN EXPORT DEMAND

In addition to the factors, such as growth of population and changes in dietary habits, which may cause the general level of demand to have a regular upward or downward trend over long periods, there are other influences which cause demand to be stronger at some times and weaker at others than the normal trend would indicate. The demand for pork products for export has been one of the most important of these variable influences.

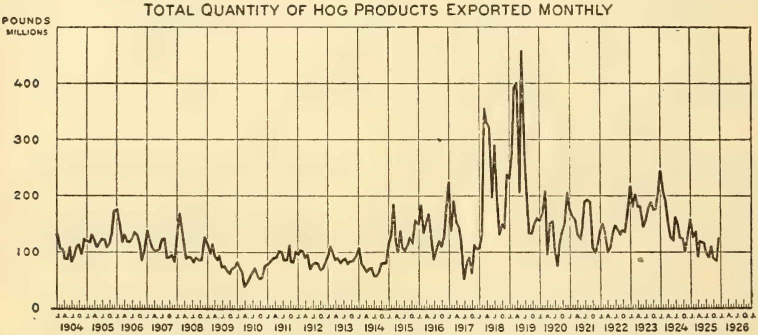

FIG. 15.—Exports of hog products monthly from 1904 to 1925, in terms of pounds of pork or equivalent. Although there were wide variations during the whole period, the pre-war period shows no very marked trend. Exports were very heavy in 1923 and early in 1924

As shown in Figure 15, from 1907 to 1914 there was no perceptible trend in the quantity of hog products exported from this country, though there were great variations from month to month and from year to year. During the period of the World War there was a tremendous increase in the volume of exports, but soon after the armistice exports fell back to something like the pre-war level. (fig. 16.)

Volume of exports alone, however, does not tell the real strength of the foreign demand for our hogs. It has already been pointed out that when prices were low our own consumers used more pork than when prices were high, without this meaning a real increase in domestic demand. The same thing applies in the case of the export demand. At times when prices were high the export movement fell away to a very small quantity; yet demand remained as strong as ever, as shown by the prompt increase of exports when prices declined.

Many times when the prices of hogs and hog products were unusually low, unusually large quantities of hog products were exported. But as soon as prices rose again the export movement fell back to its former proportions, showing that the heavy movement was not due to any real strengthening of the demand but was merely a normal response to the lower prices. The same thing is true of high prices.

Actual changes in the strength of export demand are shown in Figure 16. This chart shows the same data as are plotted in Figure 15 (the actual volume of exports) adjusted to eliminate the effect of price upon the volume. The index given in Figure 16 is thus an index of the quantity which would have been exported monthly had the price of hogs (in dollars of constant purchasing power) remained unchanged throughout the period, in so far as could be judged by observing the average relation between prices and quantity exported in the pre-war period. Since it shows approximately the quantity which would have been taken for export had the price remained unchanged, it does show more nearly the true changes in the strength of the export demand.

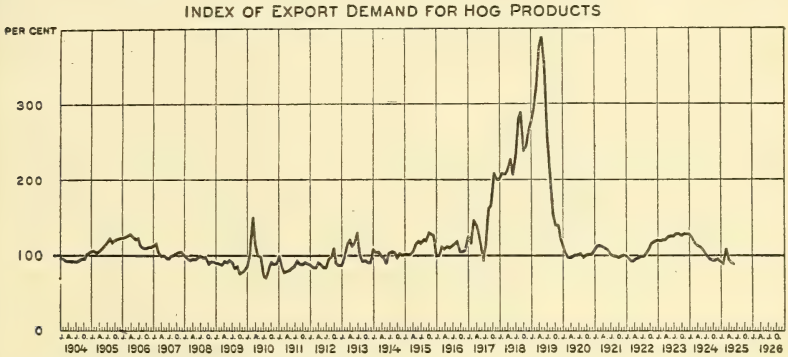

FIG. 16.—Index of export demand. This reveals the strength of export demand, as shown after adjusting the actual exports to take account of the fact that low prices cause large exports and high prices, small exports. Exports in 1923 were not particularly large when price was taken nto account

Export demand was variable, changing sometimes very rapidly. One reason for the fluctuations in foreign demand was the change in the number of hogs produced in foreign countries. Production of hogs in the different European countries varies nearly as widely as it does in this country. When their own supplies were short, that tended to strengthen their demand for our hog products; when their own production was extra large that tended to weaken the export demand over here. Changes in the foreign prices of other products like oleomargarine, which could be substituted for lard or other hog products, also tended to affect the export demand. Changes in relative prosperity of industrial workers and other pork consumers in Europe, owing to changes in wages, number of unemployed, and the like, probably were responsible for some of the changes in export demand.[7]

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[7] No attempt has as yet been made at mathematical measurement of the relative importance of the different factors affecting the foreign demand. The hog production of Denmark and Germany shows a decided tendency toward the same sort of periodic variations that characterize American production of hogs. The differences in foreign supplies could probably be measured and forecasted in the same way that variations in American production have been handled in this study. In so far as foreign demand is affected by variation in foreign supplies, this would make one step toward forecasting export demand.

During the period from 1914 to 1918 the World War sent the export demand to unprecedented heights. It is interesting to note by comparing Figure 16 with Figure 15 that the very heavy exports following the deflation period of 1920 were due largely to the exceptionally low hog prices, and therefore did not indicate a strong demand. Exports in 1923 of nearly twice the usual pre-war quantity indicated an export demand only about 25 per cent higher, when allowance for the prevailing low price was made.

VARIATION IN STORAGE STOCKS

The quantity of hog products in storage is another of the factors which men who are buying live hogs for slaughter take into consideration, as bearing upon the prices they will probably be able to get for the products from the hogs. Large storage stocks represent that much to be added to current production to give the supply of products available for consumption during the next few months; low storage stocks may mean that some of the production of the next few months will be held out of consumption and used to build stocks up to their usual level. For this reason hog slaughterers usually tend to bid somewhat higher for live hogs when the stocks of provisions are low than when they are high. The quantity of hog products in storage had a material influence upon the strength of the demand for live hogs during the period before the war, especially whenever they went more than about 40 per cent above the usual quantity in storage for the particular season of the year. Next to changes in export demand, change in storage stocks was apparently the most important cause of change in the strength of the market demand.

PROSPERITY OF AMERICAN CONSUMERS

Considerable variations in the purchasing power of industrial workers and other city dwellers took place during the period studied. It has usually been thought that this variation in the prosperity of city people had a considerable effect upon the price of hogs. The analysis showed that hog prices are affected by these changes in business conditions somewhat more than are the averages of all wholesale prices, but are not affected as much as are many other more sensitive products. At some times when business was good, wages were high and nearly every one who wanted a job could get one; at other times, when business was bad, many men were out of work and even those who were working had to accept lower wages. When business conditions were unusually good, that tended to raise hog prices somewhat more than most products, but with this exception the demand for hogs, eliminating the general change in all prices, was apparently just as good when business activity was below normal as when it was moderately brisk. Compared with changes in export demand and in storage stocks, changes in industrial activity had only a relatively small effect upon the demand for hogs.[8]

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[8] This conclusion should be taken as tentative until further work is done on this point. There is some question whether the index used to represent changes in business activity in making this study would serve as an accurate index of changes in the buying power of industrial workers. The fact that the prices had been "deflated" by the Bureau of Labor index of wholesale prices meant that as much of the variation in business activity as is reflected in that index had already been eliminated, and that only the further variation left in the data were considered. The evidence is clear that hog prices are slightly more susceptible to business conditions than are the commodities included in the Bureau of Labor Statistics index, (*17*), on the average.

PRICE OF SUBSTITUTE PRODUCTS

When the price of one food product becomes cheaper most people tend to substitute it for other foods to some extent. A number of other foods compete with hog products for places in the diet. Beef competes directly with pork, oleomargarine and vegetable oils compete with lard, and even butter may compete when lard prices become very high. A change in the price of any one of these products will have some effect upon the quantity of pork products bought, and hence will affect the demand for hogs.

Hog prices were rather sensitive to the price of fat steers during the period studied, especially at times when steers were low. When fat steer prices went higher than $7.50 per hundredweight (in terms of 1913 dollars), further changes had relatively little effect upon hog prices; but when steer prices dropped much below that point, there was a marked effect, hog prices decreasing about 10 cents on the average for each 30 cents decrease in steer prices. Since beef prices were relatively stable for some years prior to the war, however, changes in steer prices were responsible for only a small part of the changes in hog prices during those years.[9]

INTERACTION OF SUPPLY AND DEMAND

This discussion has touched on a few of the complex set of economic forces which are ordinarily summed up in the phrase "supply and demand." No consideration has been given as yet as to why the supply changes as it does. Discussion of that point will show the extent to which farmers' actions and the cost of producing hogs affect the price at which the hogs will sell. (See pp. 20 to 23.)

The discussion has indicated some of the more important factors which sway the minds of buyers and sellers, and so influence the price. In many cases the men actually dealing in the market may not realize just which are the forces affecting the situation. An increasing foreign demand, for example, may show on the market merely through somewhat larger purchases by a buyer for a packing concern which has received new orders for products packed for export. Unfavorable conditions for farrowing, and consequently fewer pigs to be raised, indicating reduced marketings some months later on, may show merely through a stronger tone in the futures provision market with, in turn, possibly some effect upon the actual cash prices. The factors which have been described are the basic underlying causes; but they actually reach the market and influence the price only through the reactions of a large number of different men and in a variety of different market transactions.

To some slight extent, or over short periods of time, a large group of dealers, either on the buying or selling side of the market, may by concerted action alter the prevailing price for hogs; but whether they can materially affect the trend of prices over any considerable time is decidedly open to question. For the period of January, 1907, to July, 1914, all but 12 per cent of the changes in the monthly price of hogs can be accounted for on the basis of changes in the different factors which have been discussed in detail.[10] This would indicate that though such dealers may be able to force the price "out of line" temporarily, or may be able to hold the price higher or lower within a rather narrow range, over a period of any considerable length they can not keep the price from averaging about what is justified by the supplies offered and the demands of consumers.

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[9] There are other products entering into competition with hog products, which were not statistically examined in this study. Lard, in particular, enters into competition with other fats and oils, such as cottonseed oil, nut oils, and possibly butter at certain times and places.

CAUSES OF THE VARIATIONS IN THE SUPPLY OF HOGS

Previous charts have illustrated how widely the number of hogs received at the important markets varies from month to month. Much of this variation is due merely to seasonal variation, and is to be expected. Two-thirds of the annual crop of pigs are born in two short periods, from March through May, and during August and September, for spring and fall pigs respectively. Since most of these pigs are fattened for about the same length of time, the monthly receipts at markets naturally reflect the monthly variation in births.

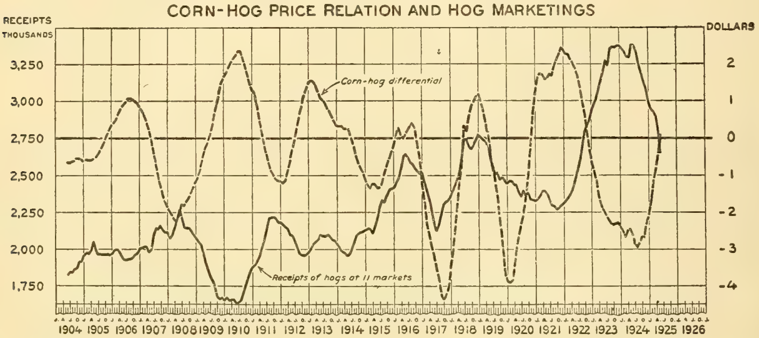

FIG. 17.—Receipts of hogs at 11 markets, and the corn-hog differential, both smoothed to eliminate seasonal variation. There are rather regular swings in the receipts of hogs, following by about 18 months the similar swings in the relation of corn prices to hog prices

The preservation of meat by curing and by cold storage has been developed to such a point that the seasonal variation in consumption is nothing like so great as is the seasonal swing in production. (Note again fig. 9, p. 11.) As a result the seasonal variation in the prices paid for live hogs is not nearly so large as it would be were there no storage of pork and pork products.

In addition to seasonal variations, however, there have nearly always been large variations in the total production of hogs from year to year. Thus in 1923 receipts were higher for each corresponding month than they were in 1924. Figure 17, illustrates just how much variation there has been in the receipts of hogs in the last 20 years, even after seasonal variations have been eliminated. It is noticeable that the moving average of receipts has swung up and down, fairly regularly, with generally about three years from one high point to the next one, although sometimes it has been as soon as two years, and once as long as five years before another high point was reached. This chart shows the receipts with a trend line drawn through them in such a way that the usual monthly variation has been smoothed out. It is evident that during some periods the movement of hogs to market has been very much larger than it has at other periods.

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[10] Based on the correlation obtained with prices from the equation on page 34

Previous discussion has shown that the almost constant changes in the supply of hogs, not only from month to month but from year to year, have been among the most important causes of changes in hog prices. For most livestock and livestock products the annual production is fairly steady. The production of milk and of butter usually changes but slightly from year to year; the number of beef animals fed out does not show violent changes from year to year; and the production of wool in this country changes only slowly. Why is it that hog production is so erratic? One reason is that hogs can be produced so rapidly that the number raised can be changed in a relatively short time. When hogs are profitable, farmers can increase in short time the number of pigs born and hogs fattened as compared with the time it takes to grow more dairy cows or beef cattle; and similarly production of hogs can be rapidly cut down when prices become unfavorable.

BALANCE BETWEEN CORN PRICES AND HOG PRICES

A second reason for the changes in hog production is that hogs are more dependent upon a single feed-crop than any other class of animals. In this country, corn is the great staple upon which hogs are produced. Although some pasturage, some tankage, in some areas skim milk and some mill feeds are fed with it, corn is still the great measuring stick by which the farmer figures what it costs to feed his hogs.

Corn prices change from year to year, as the size of the crop varies with the weather and other causes, and as the demand for the crop varies. And this variation in corn prices has made hog production sometimes seem, temporarily, very profitable to farmers, and sometimes very unprofitable.

During the period 1896 to 1914, 11.4 bushels of corn were worth as much on the Chicago market, on the average, as were 100 pounds of heavy hogs. This does not mean that 11.4 bushels of corn were used in the production of 100 pounds of hogs, but that all the costs entering into hog production were such as to be covered, on the average, by a price equal to about that much corn.[11]

The difference between the price of 11.4 bushels of corn at Chicago and the price of 100 pounds of heavy hogs may therefore be used as a measure to show when the relation between corn prices and hog prices was unusually favorable to hogs, and when it was not. When that much corn was worth less than the 100 pounds of hogs, hog prices were above average as compared with corn prices; whereas when that much corn was worth more than the 100 pounds of hogs, hog prices were below average, compared with corn prices.

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[11] Over a period of years price tends to equal necessary cost, not because the markets pay any direct attention to costs, but because the relation of price to cost governs supply. When the price drops below the equilibrium point, when farmers figure that the returns just cover the costs, they reduce their breeding operations. Later on, the reduced supplies, coming on the market, force the price higher. When the price rises above the equilibrium point, farmers are encouraged by the extra profits to increase their output; later the increased supplies reach the market and force the price down. The hog price which just equals necessary cost is apparently equal to that of 11.42 bushels of corn, for that represents the point at which farmers would apparently neither increase nor decrease their production. Hog production has been increasing during this period, however, so that the average ratio of 1 to 11.4 was not merely sufficient to maintain constant production, but was sufficient to maintain the average increase in production for this period. Since this relation has been sufficient to maintain an upward trend in production, somewhat less than 11.4 bushels of corn would represent the necessary cost for merely maintaining a constant production.

Figure 18 shows just how much hog prices did change in the last 20 years, as compared with corn prices. In this chart the light areas show periods when hog prices were above the price of 11.4 bushels of corn; the dark areas show periods when hog prices were lower than the price of that much corn. During this period there was apparently a rather regular change in the relation, first hog prices were higher for a year or so, then they were lower for about as long.[12]

REACTION OF FARMERS TO THE CHANGES IN THE CORN-HOG PRICE RELATION

When hog prices are high relative to corn prices, farmers are encouraged to increase their production of hogs. Although this increase in production takes place much faster than it does for most other livestock, still some time is required. If hog prices have been good in the summer and fall, and corn prices relatively low, many farmers may decide to produce more hogs. They breed more sows (or gilts) that fall than usual. Next spring there is a larger crop of pigs. Not until after those pigs have been fattened and shipped to market—most of them during the following fall and winter—do the actual market receipts become larger because of the more favorable prices during the summer and fall of the year before. For this reason it takes about a year to a year and a half for changes in relative prices to have much effect upon the number of hogs sent to market.

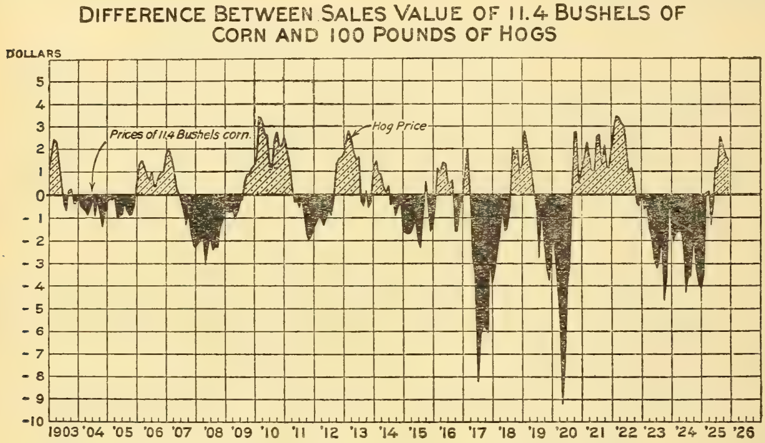

FIG. 18.—The corn-hog differential. This shows how much more or less 100 pounds of heavy hogs were worth than 11.4 bushels of corn each month from 1903 to 1925. (Both prices are at Chicago.) A fairly regular swing in the relation is evident

Figure 17, page 20, shows averages of the corn-hog differential (the difference between the value of 100 pounds of hogs and the value of 11.4 bushels of corn) and the receipts of hogs at 11 important markets. (Smoothed lines have been used for each series, so as to eliminate the usual variation from month to month.) Except during the war period, changes in the relation of hog prices to corn prices were followed by similar changes in the receipts of hogs about a year and a half later. In 1906 and early 1907 hogs were high, compared with corn; and in 1907 and 1908 receipts increased. In late 1907 and in 1908 hog prices were low compared with corn; and in 1909 and 1910 there was a marked falling off in hog receipts. After the war the same relation was again apparent; the high hog prices (relative to corn) in 1921 and 1922 were followed by increased hog receipts in 1923 and 1924, and the low prices of 1924 by reduced receipts in late 1925.

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[12] The fact that neither price was adjusted for price level exaggerates the differences for the war and post-war years. The ratio form of statement, obtained by dividing one price by the other, has the advantage of automatically eliminating these price-level differences.

Unfortunately, however, this tendency of farmers to readjust their production to the price always seems to carry them too far in the other direction, because of the piling up of the changes before they are reflected in market receipts and in prices. Thus in the spring of 1906, when hog prices (compared with corn prices) became favorable for the first time in several years, farmers increased the number of sows bred for fall farrowing. During that fall and winter the increased breedings had as yet had no effect on the market receipts or on the prices, and so with continued favorable prices breeding droves were still further increased in the fall of 1906 and the early spring of 1907. Then in late 1907 and in 1908 these accumulated increases began to show up in larger and larger market receipts, prices were forced down, and conditions were once more unfavorable to hog production.

This explains the more or less regular "cycles" which have characterized hog prices ever since records have been kept. Starting with a period of corn and hog prices favorable to hog production, farmers breed more sows, and continue to increase their breeding stock so long as the current price relation is favorable, ignoring the fact that by the time the pigs will be ready for market the relation may have changed. Then when this accumulated increase in breeding finally appears as market receipts, the market for hogs is soon oversupplied, and hog prices become unfavorable. Hog producers begin to contract their breeding. But for some time thereafter the surplus of pigs resulting from the previous heavy breeding continues to reach the markets and hold prices low, and farmers continue to reduce breeding herds, in spite of the fact that the reduction in breeding stock already made will reduce the pig crop enough to bring hogs back to a profitable basis.

So the "cycle" tends to be self-perpetuating, each period of relatively favorable hog prices causing too great an expansion in production before prices become unprofitable, and each period of relatively unfavorable prices, which in the past has inevitably followed, causing too great a reduction in breeding before favorable prices are restored.

The basic reason for the continuation of the hog-production cycle has been failure of producers to look ahead. Because corn is high and hogs are cheap *right now* is no reason to conclude that the same situation will hold *next year*. There is no way to judge the future but by the past. But apparently most hog producers have been so short-sighted in their view of the past that most of them have thought, or at any rate have acted, on the assumption that one year would be followed by another just like it, rather than by another just like those which previously had followed years when conditions were similar.

RELATION BETWEEN PRICE RATIOS AND THE WEIGHT OF HOGS

Besides the effect of the relation of corn prices to hog prices on the number of hogs produced, this price relation also affects the weight to which hogs are fattened. Every hog producer knows that it takes more corn to 10 pounds of gain on a hog weighing 300 pounds than on one weighing 200 pounds. For this reason most farmer will not feed their hogs to quite such weights when corn is high as they will when corn is cheap. Just how heavy it pays to feed a hog for a given relation of corn prices to hog prices depends upon the skill of the feeder and the quality of the hog, but it always pays to feed to the heaviest weight when corn is cheapest, and to a lighter weight when corn is dearest (*22*, pp. 11–14, 49–52, 55–58).

Figure 19 shows how this affects the weight at which hogs are marketed. This figure shows moving averages for the corn-hog differential and for the weight of the hogs. A change in the corn-hog differential was usually followed by a change in the weight of the hogs in a shorter time than it was by a change in the number of hogs marketed. This is of course caused by the fact that the weight of the hogs was largely influenced by the relation of hog prices to corn prices during the months they were being fattened, just before marketing, while the number marketed was due to changes in the corn-hog price relation in the period before the sows were bred; that is, a year or more earlier.

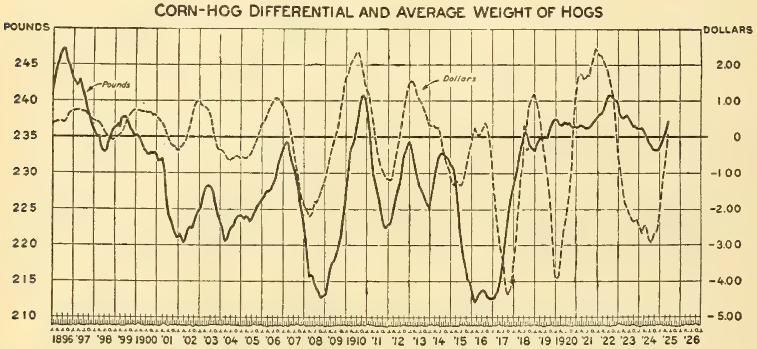

FIG. 19.—Average weight of hogs at Chicago in pounds, and the corn-hog differential in dollars, both with the seasonal variation smoothed out (by a moving average). Since 1902 a high corn-hog differential has been followed by heavier hogs in a very few months

The change in the average weight of market hogs ordinarily tends to cause some change in the relative price for hogs of different weights. At periods when corn is very cheap relative to hogs, most hogs are fattened to fairly good weight. As a result, there tends to be an oversupply of heavy hogs and an undersupply of medium or light-weight hogs, and the heavy hogs sell at a discount. Similarly, at periods when corn is very expensive relative to hogs and most hogs are sold rather light, there is frequently an oversupply of light hogs and a shortage of heavy hogs, and heavy hogs top the market. The strength of demand for lard and for pork cuts of various weights also affects the prices for hogs of different weights. Then, too, there are seasonal differences in the receipts of hogs of different weights, which cause seasonal differences in the prices. But, as is shown in Figure 20, this was usually not a very significant factor, even with the seasonal change eliminated.

During 1924 and 1925, however, this factor had a striking influence upon the prices of different weight hogs; for the last week in 1925 lightweight hogs at Chicago sold 41 cents above heavy hogs, and for the last week of 1924, 99 cents below heavy hogs.

EFFECT OF WEATHER CONDITIONS ON HOG SUPPLIES

Weather conditions form a relatively minor factor, but they must be taken into account in enumerating causes of changes in hog receipts. Unusually low temperatures in the early spring months, especially when accompanied by frequent sudden changes in temperature and a large number of cloudy or rainy days, tend to result in heavy losses of pigs at farrowing time. This is particularly true on farms poorly equipped for caring for the young pigs, but even on the best-equipped farms such conditions are almost sure to result in some loss.

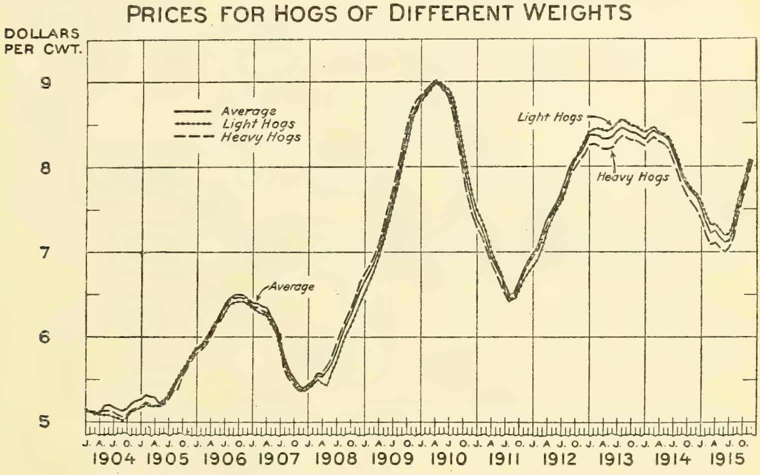

Fig. 20.—Prices for light, average, and heavy weight hogs at Chicago, 1904 to 1915, with seasonal variations eliminated. There is some tendency for the prices of different weights to change at different phases of the hog "cycle," but the difference is not very great. The data are 12-month moving averages

Differences in the size of the pig crop resulting from these variations in weather conditions are responsible for about one-sixth of the variation in market receipts of hogs. To some extent this obscures the effect of economic changes upon hog production. The effect upon subsequent production is so dominant, however, that these purely random changes caused by weather conditions can not prevent the results of price changes from showing up fairly clearly even in "raw" data.

FACTORS INDICATING SUBSEQUENT CHANGES IN HOG PRICES

During the period 1904 to 1914 hog prices had a steady upward trend as shown in Figure 21. This was due to the influence of the decreasing value of money, combined with the fact that demand was increasing faster than supply. It is evident from the figure that the general tendency of the price was to swing first above the trend and then below, each complete swing taking about three to four years.

It has been shown that there has been a rather definite sequence of events in the hog market, responsible for the swing, except under such abnormal conditions as during the war period and the following period of readjustment. Since events have usually followed in this rather regular manner, it is possible to pick out certain factors whose current values will serve to indicate what conditions in the hog market are most likely to be some months later on.

The general prosperity of consumers in this country, as measured by industrial activity, was another factor affecting the demand for hogs. It is possible to forecast changes in industrial activity to some extent from the changes in the prices of stocks in the stock market, stocks generally starting to increase in value a few months before the lowest point of a period of "depression" is passed, and generally beginning to decline in value a few months before the high point in a period of "expansion" is reached. Even as far as six months ahead, for the pre-war years the prices of stocks were found to have a relation to the price of hogs, indicating that coming changes in demand might be indicated that far ahead.

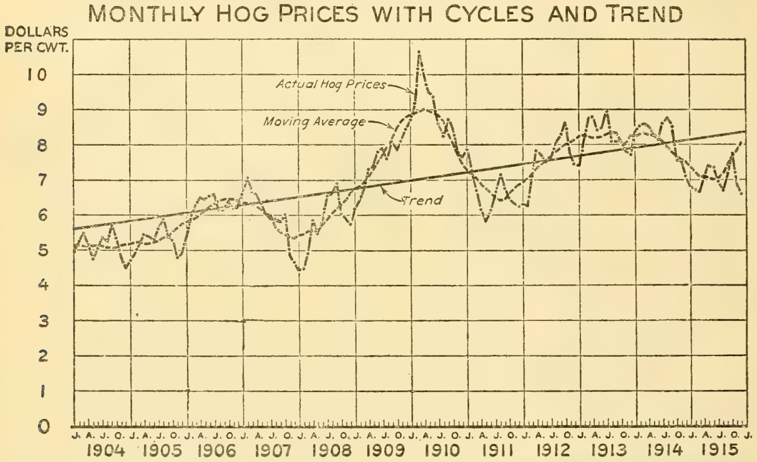

FIG. 21.—Actual hog prices, prices with seasonal variation eliminated, and straight-line trend, for period 1904 to 1915. This shows how hog prices swing first above and then below the long-time trend

Exhaustive trials of the different available series show that four series of data are best suited to use in constructing an index of these future developments. These series are (1) the corn-hog ratio, reflecting conditions most likely to cause farmers to change their breeding plans; (2) the price of corn, indicating the weight to which hogs are likely to be fattened; (3) the weight of hogs, indicating the current balance between corn prices, hog prices, and breeding animals; and (4) the prices of the stocks of industrial corporations, indicating what the speculative community thinks of the outlook for general business conditions.

Combining these four factors into a single index according to the methods described in detail later (see pages 46 to 50), a forecast of hog prices for the period 1903 to 1914 was computed, as shown in Figure 22.

This figure shows the actual price of hogs each month during the period, and an estimated price computed from these four factors, using data available at least six months earlier. It is evident that the price estimated from the earlier data comes very close to the actual price; it includes about 88 per cent of the variation in the monthly averages of the actual prices. Considering only the general movement of both the actual and estimated prices, the relation is even closer, the smoothed estimated price including 94 per cent of the variation of the smoothed actual price. This shows that during the pre-war period the monthly average of hog prices could have been forecasted six months in advance with a very high degree of accuracy.

These four factors, three indicating what changes may be expected in supply, and one indicating what changes may be expected in demand, would have given a definite basis for forecasting the price of hogs six months in advance. Figure 22 has shown how accurately this could have been done during the pre-war period.

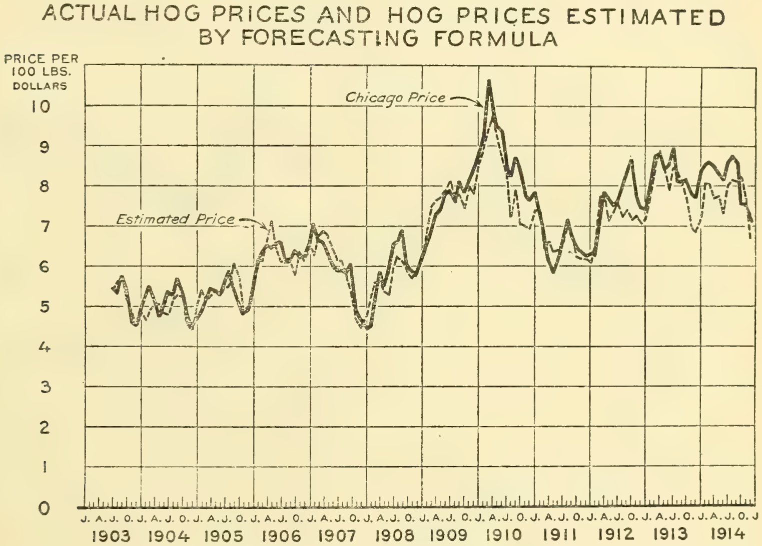
ACTUAL HOG PRICES AND HOG PRICES ESTIMATED BY FORECASTING FORMULA

FIG. 22.—Actual hog prices and prices estimated by the forecasting formula. The estimated prices were computed by a method which used data available six months before the price being studied. By this method the trend of prices can be forecasted six months in advance

There is a futures market for hog products, where various provisions can be bought or sold for delivery at future dates. As would be expected, the prices of these "futures" is a better guide to what hog prices will be later on than is merely the present price of hogs. Figure 23 shows the prices of heavy hogs compared with a price estimated from the price of lard and short ribs "futures" for five months earlier, and with the price estimated from the four factors by the mathematical method. It is evident that the "futures" prices would not have given anything like so good a forecast of hog prices as would the mathematical method. For the period shown, the errors in estimating on the basis of the prices of "futures" averaged just about twice as great as the errors when the price was estimated on the basis of the factors discussed.

Since the World War, the variations in European demand and in other factors have been so great that it has not yet been possible to forecast hog prices with the same exactness that they could have been forecasted under pre-war conditions.

There seem to have been rather rapid shifts in the consumption habits of American consumers during recent years. Factors which may have been partly responsible for this are (1) the changes made in diet during the war period, under the influence of widespread publicity to "eat less meat" which may have had a more lasting effect than was intended at the time; (2) the publicity given to such recent discoveries as vitamins in the field of nutrition; (3) the extensive advertising or drives to increase the use of dairy products and various fruits; and (4) the higher wage level of the city population since the war (in terms of real purchasing power) which has furnished the means to sustain a higher standard of living. As a net result, the level of demand for pork and its products since the war, as found by definite statistical study, has been markedly different from what it would have been had it followed the pre-war trend.

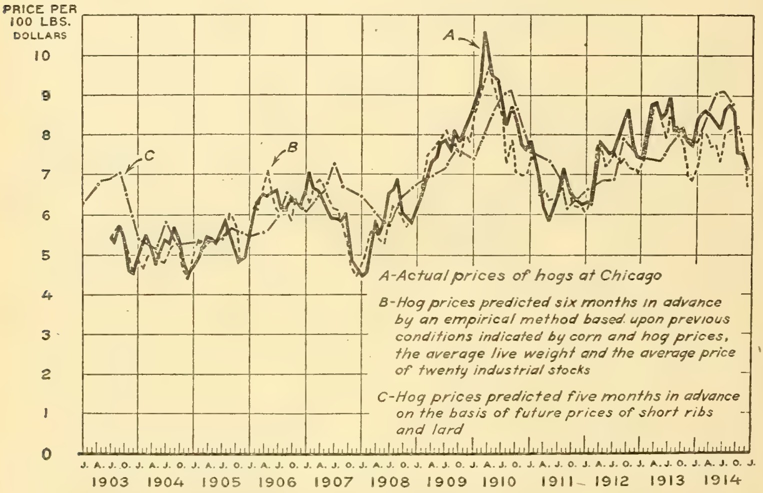

FIG. 23.—Actual hog prices, prices estimated by the forecasting formula, and prices estimated on the basis of "futures" prices for short ribs and lard. The latter forecast (C) is not nearly so accurate as is the mathematical forecast (B)

At the same time, a new factor has been injected into the hog market situation in the shape of the "pig survey" of the Bureau of Agricultural Economics. On the basis of reports from a very large number of farmers, this survey gives an estimate of the size of the "pig crop" twice a year, and shows what changes farmers intend to make in their breeding operations. These surveys so far have forecasted both the size of the next pig crop and the total marketings from each crop with a very fair degree of accuracy. To date, they have checked with the changes that would be expected on the basis of the statistical study presented above. The breeding intentions for the spring crop of 1926, however, did not show the increase which would be expected from conditions at that time.

During the years 1924 and 1925 the hog market seems to have returned more closely to pre-war conditions than at any intervening time. Figure 24 shows the actual monthly prices of heavy hogs at Chicago for the period July, 1924, to January, 1926, together with hog prices estimated from the four factors of six months or more earlier, with forecasted prices through to June, 1926. These forecasts were obtained by using the pre-war estimating equation (given in detail in the subsequent statistical section) and assuming a flat trend for the price of hogs at such a level as to give the 1924 and 1925 estimated prices the same average as the actual prices. Although the two curves are not so close as they were for the pre-war data, they do show a striking similarity.

For the 19 months for which both figures are given, there is a correlation of 0.806 between the actual and estimated prices, showing that the latter shows 65 per cent of the variation of the former, in contrast to 88 per cent for the pre-war comparison.

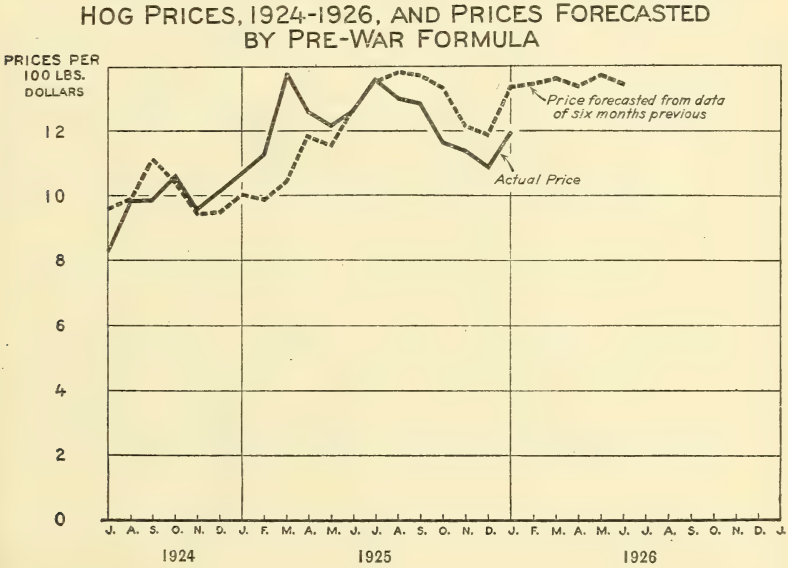

FIG. 24.—Application of forecasting formula, computed for the pre-war period, to 1924 and 1925. The movements in actual prices during this period preceded by several months the movements indicated on the basis of the pre-war relationships

Widespread publicity given the pig-survey figures has tended to make the hog market more responsive to future changes in receipts than it has been in the past; hence the relative importance of the various factors determining the price is probably somewhat different than it was for the period shown in Figure 22. Thus it is noticeable in Figure 24 that the upward price movement in 1924, and the downward movement in 1925, both actually occurred some months earlier than would have been expected on the basis of the pre-war relations alone.

As soon as the pig survey has been in operation for a period of time long enough to get a satisfactory measure of the market's response to this new factor it should again be possible to make a highly accurate forecast of hog prices on a mathematical basis.

STATISTICAL BASIS FOR THE CONCLUSIONS

Certain assumptions upon which the following analysis is based should first be stated and discussed. These assumptions are briefly:

(1) The demand and supply of hogs remaining unchanged, the price of hogs will vary with the general level of prices; that is, a given quantity of hogs will exchange for a fixed quantity of other commodities. (The accuracy of this assumption is tested in part of the analysis.) Except where explicitly stated otherwise, the term "price" will be used to mean price in terms of units of constant purchasing power; that is, current dollar prices divided by the price index used.

(2) For the purpose of studying the demand schedule and the level of demand, supply may be stated as merely the volume of product reaching the market. This leaves the study of the causes affecting the quantity supplied—really, the study of the supply schedule—out of consideration to be handled as a separate problem.

The supply which affects the price at a given time may be partly the immediate or short-time supply, and partly the general or long-time supply. How the market becomes cognizant of the trend of supply, how it reacts to estimates of the supply available on farms, and how it reacts to forecasts of supply, are all specific problems connected with this assumption.

(3) At any given moment, the price that will be paid is a function of the supply. The statistical analysis should determine just what is the nature of this relation.

(4) The price realized for a given supply reaching the market during a given period constitutes a single point on a curve expressing the relation between supply and demand at that time; hence over a succession of periods during which demand remains unchanged, the different prices realized for the different quantities supplied in each period indicate quantitatively the nature of the relation between supply and price.

(5) A change in demand will be shown by (*a*) the movement of a larger supply at the same price, (*b*) the movement of the same supply at a higher price, or (*c*) by the movement of a different supply at a higher price than would have been obtained for the same supply at the previous level of demand. (This depends upon having a demand schedule generalized for the previous condition under assumption 4.)

Among the factors which may be responsible for changes in market demand, the following may be mentioned: (1) Growth of population, (2) changing dietary habits, (3) periodic changes in the buying power of consumers, with changing business conditions, (4) changing prices of substitute products, (5) changing foreign demand, and (6) the quantity of hog products in storage.

If the assumptions stated are true, it follows that the price at any time can be expressed as a function of variables representing the different factors mentioned. As will be shown in the following discussion, functions determined mathematically for the actual observations do account for as much as 93.6 per cent of the observed (root-mean-square) variation in actual (not "deflated") prices, or, in terms of "determination," the factors included represent 87.6

per cent of the total of the forces affecting price variations. That is, it is not possible for any force or forces not represented (directly or indirectly) in the equation to be greater than 12.4 per cent of the total determinant of price changes over the period.

The mathematical study reveals (1) that the prices (in terms of other commodities) vary with supply, there being a different relationship for short-time and long-time supply, but the demand curve being negatively inclined for both; (2) that demand had an upward trend over the period 1907 to 1914, due both to population growth and to a growing demand per capita; (3) that demand varied sometimes above and sometimes below this normal upward trend (*a*) as industrial conditions changed, (*b*) as the prices of substitute products varied, (*c*) as the European demand varied, and (*d*) as the supply of the product in storage varied.

These conclusions are reached by a purely empirical mathematical process, using the actual data on prices and the other quantities involved. The fact that they coincide so closely with the assumptions stated, and that such a large part of the price variation can be accounted for solely upon the mathematical relationships, indicates that the general hypothesis is true, and that as far as average prices for a month or longer are concerned, the price of hogs is largely determined in the central market by the supply and by the relation of the supply to the demand for the particular period.

The demand curve for a given period may be thought of as moving forward through time, and "generating" a solid surface in its wake. The curve would move forward with a generally upward trend, swinging above and below the trend in more or less rhythmic fashion with changing industrial activity, and also moving up or down slightly from time to time in response to changes in the price of alternative products, in the storage supplies, and in foreign demand. In addition, the shape of the curve itself must be thought of as changing as it moves forward, the growing demand implying not merely an upward shift in the curve, but also a tendency for the shape of the curve itself to change.

Figure 25 may help the reader to visualize this concept. Here only the trend of growth in the demand schedule and the change in the shape of the demand curve have been depicted, leaving the wavelike and other minor fluctuations to be supplied mentally.

The price for each month may be conceived as represented by a small black ball, suspended above the line for its own date, at the height of the average price for that month, and as far over from right to left as indicated by the supply for that month. There would necessarily be only one ball for each month. These balls, however, would all be very close to the demand surface, a little above it for those months when the actual price was higher than the price as shown by the correlation formula, and a little lower for the months when the actual price was a little below the estimated price. In general, however, it would be seen that the demand surface approximated the position that these prices occupy, as they were thus suspended through space and time.

The mathematical procedure of fitting the net regressions should be thought of as simply the process by which this surface is generalized in time and space. Starting with only the location of the dots, one dot to each period, and knowing the accompanying values of other factors which reflect the different things with which the shape of the surface is expected to vary, the shape of the whole surface is measured by the solution of the mathematical equations which give data for computing its most probable position at any moment, under the assumptions implicit in the equations used.[13]

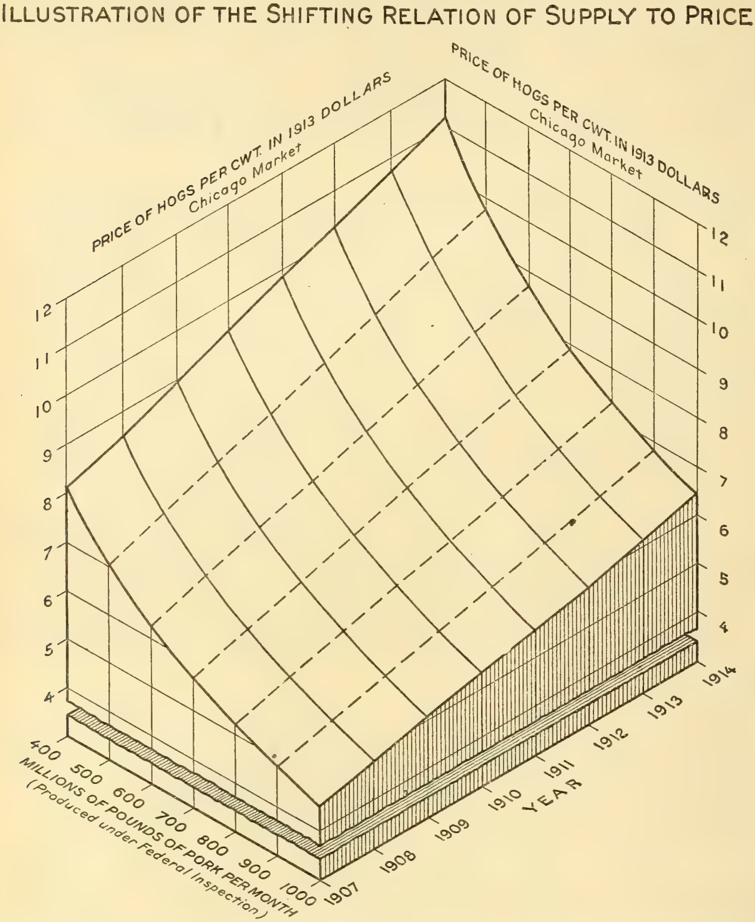

FIG. 25.—The change in the demand for pork, 1907 to 1914. This shows the upward shifting of the demand schedule and also the change in the shape of the curve as demand increased

The preceding discussion presents the basic assumptions upon which the subsequent analysis is based. Not all apply in every case, and some of the solutions use additional assumptions, which are at least implied in the discussion even if not explicitly stated. The specific conclusions to be drawn from the results of these analyses may vary as the viewpoint of the particular person doing the explaining varies.

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[13] For a nonmathematical discussion of the assumptions which the statistical analysis itself involves, see the first part of the following: EZEKIEL, M., A STATISTICAL EXAMINATION OF FACTORS RELATED TO LAMB PRICES. Jour. Pol. Econ. [now in press].

But it seems that at least the following generalizations can be stated as proved, though the specific quantitative relations found may be subject to modification with further investigation.

(1) Between successive periods, with other factors remaining the same, the price of hogs is a function of the supply, a given change in supply causing a proportionately smaller change in price.

(2) The curve expressing this function, which corresponds to the classical economist's conception of the relation of price to the quantity demanded, is negatively inclined, with an average elasticity of about 1.6.

(3) The general level of the demand curve for hogs was moving upward during the decade preceding the World War. Since the war, its movements have been so irregular as to make its present position or trend largely indeterminate.

BASIC DATA

Tables 1 and 2 in the appendix give the basic data used in this study and the sources from which obtained. Much of the price data consists of unweighted averages, but that is all that is available for the early periods. The figures on receipts and slaughter are necessarily subject to some degree of error, and include only part of the actual production of hogs, but represent the best available information on the subject. It is probable, too, that the market receipts and inspected slaughter represent more the forces to which the markets respond than does the total slaughter, including that on farms and in purely local establishments. These tables also contain certain series of derived figures referred to at various points in the statistical discussion.

DEMAND CURVE AND TREND OF DEMAND

A statement of the demand curve and the trend of demand (note assumptions 4 and 5) was obtained by a multiple correlation study of the relation of supply to price for the period 1907 to June, 1914. The slaughter under Federal inspection was used as the best available measure of commercial production.

The following factors were included:

X_1 Total live weight of hogs slaughtered monthly, adjusted to a 30-day month.
X_2 Average of X_1 for previous six months (cumulative average).
X_3 Moving average of X_1 (X_2 centered).
X_4 Storage of pork provisions, adjusted to eliminate normal seasonal variation.[14]
X_5 Index of business cycles.
X_6 United States population.
X_7 Price of steers÷Bureau of Labor Wholesale Price Index.
X_8 The index of European demand (explained on page 39).

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[14] In discussing the factors influencing the demand for a given product it is necessary to have a clear understanding of the precise point in the marketing process at which the demand is to be measured. Thus if the demand of consumers for hog products was under consideration, the supply of hogs at the market, the quantities of hog products in storage, and the quantities of products in the hands of wholesale or retail dealers would all constitute part of the supply. The only factors which could be considered demand factors would be those which would influence the willingness of consumers to pay certain prices for certain quantities of pork or lard, such as the extent of unemployment; the price of alternative products, like beef, veal, or vegetable oils; and similar factors. Likewise, in considering the factors which influence the demand for live hogs in the central markets, it is necessary to take account of the factors which influence the buyers in making their bids for the animals received at the market. Although the price for which they can sell the products at wholesale is certainly one of the most important factors, the supply of hog products in storage is another important factor. If their reserve supplies are very low, and if prices are steady or rising, bidding will be much more active—the level of demand will be higher—than it would be if storage stocks were heavy. At this point in the marketing process the stocks in storage constitute a factor affecting demand; from the point of view of the consumer they are merely a part of supply.

X_9 Time (numbering months from 1 up). This allows for changes in consumption habits and other changes in demand with the passage of time.

X_{10} The Bureau of Labor index of wholesale prices for all commodities (hereafter referred to as the "Bureau of Labor Index"). (*17*).

X_{11} The price of hogs, not adjusted in any way.

The data were taken monthly, giving 90 observations.

Factors X_1, X_2, and X_3 were included as different measures of the influence of supply; factors X_4, X_5, X_6, X_7 and X_8 as forces influencing demand; X_9 to allow for any trend in price apart from that accounted for by the factors stated; and X_{10} to adjust for the effect of changes in the value of money upon hog prices.

Since practically all of the factors were thought to have a relative rather than an additive relation to price, all of the factors except X_9, time, were stated as logarithms (*6*).

Correlating the factors thus stated, a multiple correlation of hog prices with the 10 other factors of $R=0.936$ was obtained. Correcting this to take account of the fact that 10 constants were determined with only 90 observations,[15] the true multiple correlation is reduced to 0.928.

The regression equation is as follows:

(1) $\log X_{11}=-0.09443 \log X_1+0.15888 \log X_2-0.21986 \log X_3-0.23675 \log X_4-0.07250 \log X_5+2.23777 \log X_6+0.04759 \log X_7+0.22659 \log X_8-0.03036 X_9+1.63099 \log X_{10}-K.$

The value of the constant (K) in this equation varies according to the units in which the different variables are expressed.

The variable X_{10} represents the price index, so moving the regression value for that variable to the left of the equality sign gives the regression equation for the prices deflated according to the observed relation.

The fact that the best fit is obtained by dividing the actual prices by the price index raised to the 1.63 power may mean that hog prices are more sensitive to variations in the price level than are most commodities. For example, on this basis a change from 100 to 125 in the wholesale prices of all commodities would mean a change from 100 to 144 in hog prices, and a change from 100 to 75 in wholesale prices would mean a change from 100 to 63 in hog prices. However, it is possible that part of the effect of changes in business activity upon hog prices is reflected in this relation, the index of wholesale prices being itself one measure of business activity. For this reason this particular solution, though giving a very good correlation with actual hog prices over the period, does not give a satisfactory basis for getting a demand curve.

It should be noted that the net regressions shown in equation 1 show a larger effect for changes in storage, variable X_4, than they do for changes in X_1, X_2, or X_3, the three variables representing supply. As the stocks in storage vary rather closely with the supply, much of the real effect of the quantity supplied upon prices is shown as a response to variations in this storage factor. That is, the fact that the use of storage irons out the differences in supply from period to period obscures to some extent the basic relation between supply and price.

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[15] Corrected $R^2=1-\frac{1-R^2}{1-m/n}$, where m=number of constants, and n=number of observations. (*21, p 41.*)

What is really needed in getting a demand schedule is a statement of the relation between price and consumption—that is, a statement of the quantities which would be consumed during a specified period if offered at various prices. Such a statement could be obtained by a direct study of the relation of monthly consumption of pork and pork products to pork prices and other factors. Lacking such a study, the demand schedule must be inferred from the relation of the market receipts or slaughter to prices and other factors, as was indicated in assumption 5.

Before stating the means by which this has been done, it is worth stating the relative importance of the different factors affecting the price, as shown by the multiple correlation just discussed. In the system of variables shown, the relative importance of each factor was as follows:

		Per cent
X_1	Monthly slaughter	5. 1
X_2	Slaughter for six months previous	−5. 0
X_3	Six-months moving average of slaughter	9. 0
X_4	Storage stocks	19. 3
X_5	Business activity	−1. 4
X_6	Population of United States	27. 2
X_7	Price of steers	1. 6
X_8	European demand	2. 7
X_9	Time (changing consumption habits)	−5. 9
X_{10}	Bureau of Labor all-commodity wholesale price index	35. 1
	Total determination by all factors (R^2)	87. 6

The values preceded by the sign (−) are those where the joint relation with other variables was such that the net regression with price was of opposite sign from the gross correlation. This, however, does not mean that they were not of significance as factors influencing price; it merely means that their effect on price was, on the average, in an opposite direction to the way the price actually moved, rather than as a direct contribution. In general, these determination coefficients, taken without regard to sign, give a measure of the relative importance of each of the different factors, on the basis of the specified system of relations.[16]

These coefficients of determination are statements of the proportion of the total variability of the dependent factor, hog prices, which for the period studied can be mathematically related to the variability of each of the other factors included in this particular study. It must be remembered that factors not included in the regression equation may yet influence price; if they do so either through or concomitantly with any of the independent factors already included, their effect is already included in the coefficient for such variables. It must also be remembered that these coefficients are computed while simultaneously allowing for the effect of the other variables stated, but not taking into account any of the other possible factors affecting prices. Dropping any of the significant factors from the group, or adding an additional factor to those considered, would cause a shifting in the computed net relation of the other factors to hog prices and hence some change in the values of the coefficients of determination.

---

[16] These coefficients are computed by the following formula:
Determination of X_{11} by X_2, in the system of relations described $=(b_{11,2:1,3,4,5,6,7,8,9,10})\ (r_{11,2})$; determination by $X_3=(b_{11,3:1,2,4,5,6,7,8,9,10})(r_{11,3})$, etc. For a fuller statement of the meaning of these "coefficients of determination," see Smith (*21, p. 42*).

For this present study, therefore, the coefficients of determination, showing the relative significance of each variable *over the period studied and for the particular combination of variables included*, may be used as indicating only in a very general way the relative significance of each of the independent variables as factors related to hog prices. They would be modified by the inclusion of other independent factors, hence can not be interpreted as measures of absolute relationships.

For the next step in getting at the demand curve, the hog prices were deflated; that is, divided by the Bureau of Labor all-commodity index of wholesale prices (*17*). This adjusts the prices to a basis of constant "purchasing power," and leaves any further relation between hog prices and the price level to show up in the relation to the index of business cycles and other related factors.

At the same time, factors X_2, slaughter for the previous six months, and X_4, stocks in storage, were dropped from the factors considered. Storage was left out for the reason already given—that with it in, much of the effect of supply upon price showed up by way of the storage regression—and the slaughter for the previous six months was left out for the reason that it was more closely related to storage stocks than to the moving average of slaughter[17] and would have reflected much of the effects of storage had the latter alone been left out.

Dropping out the three factors, X_2, slaughter for six months previous, X_4, storage stocks, and X_{10}, the price index, left seven independent variables to be correlated with the new dependent variable—hog price divided by the index of wholesale prices—which will hereafter be designated X_{12}. The multiple correlation of the seven independent variables with the new dependent gave $R=0.862$, or an effective $R=0.850$, after correcting for the number of variables considered. While decidedly lower than the previous corrected R of 0.928, this is still fairly close, and serves to give an approximate measure of the demand curve.

The regression equation for this solution is as follows:

$$(2)\ \log X_{12}=-0.09406 \log X_1-0.52655 \log X_3+0.30832 \log X_5 +2.60325 \log X_6-0.33002 \log X_7+0.3546 \log X_8+0.02428 X_9+(K)$$

The relative importance of the factors is as follows:

		Per cent
X_1	Monthly slaughter	6. 3
X_3	Moving average of slaughter	26. 0
X_5	Business activity	5. 7
X_6	Population of United States	37. 6
X_7	Price of steers	−13. 1
X_8	European demand	6. 2
X_9	Time (changing consumption habits)	5. 6
	Total determination by all factors (R^2)	74. 4

After leaving out the upward trend of prices due to the growth of population and the increasing per capita demand (the regressions are positive for both X_6 and X_9), the supply is the dominant factor in determining the price. As shown by both the net regression coefficients and the coefficients of determination, the trend of supply has a much more important effect upon the price than the supply during a single month, a given change in the trend of supply having relatively much more effect upon prices as a similar change in the supply for a single month (the regression coefficient for X_3 is -0.52655, and for X_1 is but -0.09406).

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[17] $r_{2,3}=+0.53$, $r_{2,4}=+0.62$.

With all other factors constant, the relation of supply to price is given by the equation:

$$(3)\ \operatorname{Log} X_{12} = -0.09406 \log X_1 - 0.52655 \log X_3 + (K)$$

This is simply equation 2 with all variables other than X_1 and X_3 dropped out. The values for X_{12} given by this equation would be applicable only when all the other variables had their average values (using the geometric averages for the variables correlated in terms of logarithms). Since both X_1 and X_3 in equation 2 are stated in the same units, the relation of price to supply could be stated.

$$(4)\ \operatorname{Log} (X_{12}) = -0.62061 \log (X_1) + (K)$$

for periods when both X_1 and X_3 have the same value. This equation expresses the combined effect of both the trend of supply and the current supply upon the price, and gives an approximate measure of the demand curve for hog products.

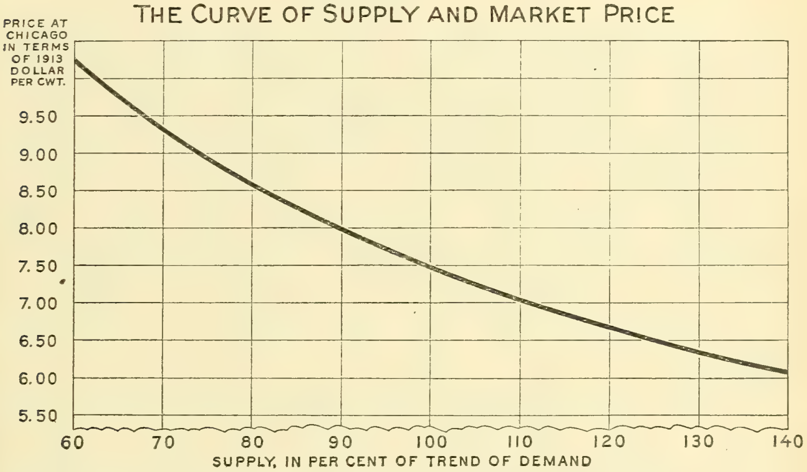

FIG. 26.—The demand curve for hogs. This shows the variations in price for given variations in supply, after eliminating the effects of other factors affecting price

This net regression was tested for linearity by the approximation method for multiple curvilinear correlation (*5*), and it was found that the straight line (in terms of logarithms) was the best fit for the demand curve.

It should be noted at this point that the first differential of equation 4 is necessarily a constant. That is to say, a given relative change in X_1 always causes the same relative change in X_{12}, regardless of the value of X_1. This demand curve therefore has a constant elasticity; at any point on the curve, the relation between a very small percentage change in supply and the percentage change in price is the same. Thus for an increase of 1 per cent in supply, price would decrease 0.62 per cent. The actual coefficient of elasticity is 1.61; that is, the change in quantity is at the rate of 1.61 times the rate of change in price.

Figure 26 is drawn to equation 4 with the quantities expressed in percentages of the average supply, rather than in terms of actual quantities which would have applied to only the central year of the period.

The trend of demand is obtained from equation 2 by the following process:

Holding all the factors except supply, price, population, and time constant, the equation (in terms of deviations from the means) becomes:

$$\text{Log } x_{12} = -0.62061 \log x_1 + 2.60325 \log x_6 + 0.02428\ x_9$$

and for a price constant at the average price,

$$0 = -0.62061 \log x_1 + 2.60325 \log x_6 + 0.02428\ x_9$$

rearranging

$$(5)\quad 0.62061 \log x_1 = 2.60325 \log x_6 + 0.02428\ x_9.$$

Equation 5 gives the supply which, at any given time, can be sold for the average price, assuming that business activity, the price of steers, and European demand are all average. Putting the variables back into terms of whole numbers instead of deviations from the means [18] the equation becomes:

$$\text{Log } X_1 = \frac{2.60325 \log X_6 + 0.02428\ X_9 - 208.60798}{0.62061}$$

Substituting the values of X_6 and X_9 for the different years in this equation, the upward trend used in plotting Figure 25 is obtained.[19]

Besides the two correlations mentioned above, several other sets were solved. In one, hog prices divided by the price index was substituted for the raw prices, and these deflated prices (X_{12}) correlated with the whole set of 10 independent variables first used, leaving out only the price level (X_{10}). This gave a multiple correlation of $R_{12.\ 1,2,3,4,5,6,7,8,9} = 0.895$, for the period covering 1907 to June, 1914.

Correlation of the same variables for the postwar period from December, 1921, through June, 1924, gave a multiple correlation of $R = 0.88$. In this case, however, the demand seemed to have a decidedly downward trend, both time and population showing negative regressions.

Combining the pre-war and post-war periods (1907 through June, 1914, and 1921 through June, 1924), and computing the multiple correlation for the seven independent variables used in obtaining the pre-war demand curve, a coefficient of $R = 0.861$ was obtained, as compared with $R = 0.862$ for the same factors for the pre-war period alone. The demand curve was practically identical with that obtained from the pre-war solution but the trend of demand was somewhat different, showing an upward trend for the pre-war years and a downward trend for the post-war years, as the net result of a positive net regression on population and a negative net regression on time. The various studies of the post-war demand lead to the conclusion that the steady upward trend in demand which characterized the pre-war period had (in 1924) not yet reappeared after the abrupt break due to the abnormal war conditions, and that the level of demand has been fluctuating since the war. Not until a longer period of post-war observations is available will it be possible to determine the present trend of the demand for hogs with the precision with which the pre-war trend can be stated.

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[18] For the method of computing the constant in this process, see (*23*) *p. 11, note 7.*

[19] Since the correlation from which these regression coefficients were obtained was not very near perfect ($R = 0.862$), the change in price with changes in supply when reversed as just indicated, does not give a very accurate description of changes in quantity demanded with changes in prices asked. See (*33, p. 526–538*).

INDEX OF FOREIGN DEMAND

For exact statement, demand must be defined with regard to "the quantity taken at a certain price." Hence the foreign demand for any product can not be measured merely by taking the quantity exported, for the quantity exported is largely determined by the price—large exports at low prices do not necessarily indicate any stronger export demand than do small quantities exported at high prices. In computing the index of export demand the object, therefore, was to obtain a measure of how large the exports were relative to what ordinarily they would have been for the prevailing price at that time.

The first step in the process was the computation of an index of the physical volume of exports. This was done by weighting the quantities of each product exported each month by the average export price for the period June 30, 1910, to June 30, 1914, with pork itself as unity. This gave weights of 1.00 for canned, fresh, or pickled pork, 1.19 for bacon, 1.22 for hams and shoulders, and 1.03 for lard. The resulting index of the physical volume of exports is given in Table 2.

The index of volume of exports was then correlated with the deflated price of hogs (X_{12}) and time, for the period 1907 to 1915, giving a multiple correlation of $R=0.695$. The regression on time was practically zero, showing that there was no significant trend in exports over the period. A curve was then constructed by the method of curvilinear correlation, to show the net effect of prices upon exports, and the exports for each month expressed as a percentage of what they would have been had they had the normal relation to price at that time, as shown by the trend and the curve. These percentages were found to have some seasonal movement, so they were averaged by months for the period 1907–1913, giving the following statement of the regular seasonal variation in export demand:

Average seasonal variation in export demand—Exports, percentage of normal amount for the prevailing price

	Per cent		Per cent
January	96. 0	July	103. 0
February	98. 7	August	100. 4
March	101. 9	September	102. 0
April	102. 0	October	101. 2
May	100. 7	November	96. 7
June	101. 8	December	95. 6

The final index of export demand was then computed by dividing the previous percentages by the average seasonal variation, eliminating the regular seasonal variation from the index. As thus computed, the index represents the relation between the exports of any given month and the quantity that ordinarily would be exported that month, taking account of the prevailing price, the time of year, and the long-time trend in export demand.

The trend in export demand was very slightly downward for the pre-war period. The relation of price to exports is shown in Figure 27. It is evident that this export demand curve is very different from the total demand curve shown previously. The total curve measured the effect of supplies upon price; this curve measures the effect of prices upon exports. It is probable that a more detailed study upon this particular point, taking account of more of the factors other than price which may effect exports, would give a curve which would be more like the traditional demand curve; but the curve as it stands serves as at least a rough device for correcting the exports to take account of the changes in volume in response to price changes.

In so far as this curve does measure the true export demand, it would indicate that during the pre-war period foreign demand for pork was ordinarily rather elastic up to the point of exports of 100,000,000 pounds per month, but that above that point the elasticity became much less, and relatively larger reductions in price were necessary to cause further increases in exports.

INDEX OF TOTAL DEMAND

An index of total demand was arrived at by exactly the same general procedure as was the index of foreign demand. In this case, however, it was hardly fair to measure demand as the relation between the actual takings and the quantity normally taken at that price, since in point of fact the price was adjusted to such a point that all offerings would be taken. Hence, total demand was measured by the relation between what the price would ordinarily have been for the given supply and the actual prices. This left all the factors affecting demand out of consideration, the index of demand itself to be considered as a composite measure of the forces of demand.

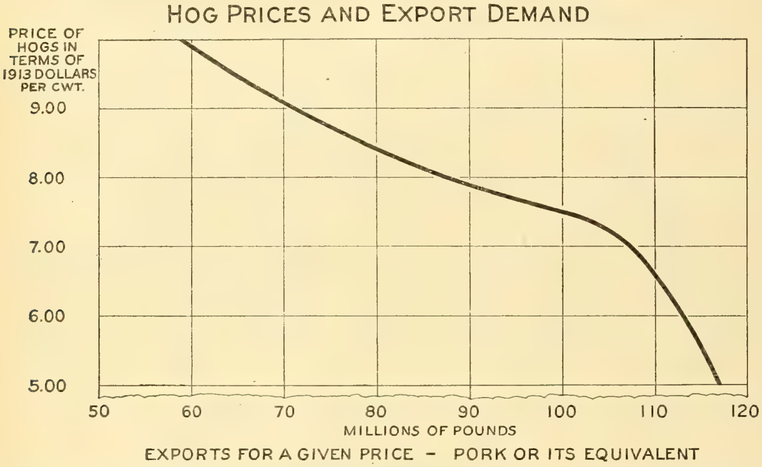

FIG. 27.—The export demand for pork and other hog products. This curve shows the average effect of changes in hog prices upon the quantity of pork or lard exported

The following factors were used in the first correlation, taking monthly data from 1904 to 1915, inclusive:

X_{15} Receipts of hogs at 11 markets, 12 month moving averages.
X_{16} Time.
X_{17} The price of heavy hogs ÷ Bureau of Labor index all commodities ÷ average seasonal variation.

The average seasonal variation in hog prices was computed by taking a straight-line trend for the period 1896 through 1915, expressing the price each month as a percentage of this trend and then averaging these percentages for each month. By taking such a long period, a sufficient number of complete cycles was included to eliminate any appreciable error in the seasonal averages due to the cyclic variation. No attempt was made to determine whether there had been any change in the seasonal variation over the period. It is probable that the normal seasonal variation during recent years has been less marked, as marketings have been more evenly distributed through the year recently than they were in previous decades.

Figure 28 shows the normal seasonal variation as determined for this pre-war period.

The receipts and time gave a multiple correlation with the price thus deflated for price level and seasonal variation of $R_{17.15,16} = 0.827$. Tests by the approximation method showed no perceptible curvilinearity to the regression of price upon receipts. Leaving demand factors out of consideration apparently was sufficient to mask the usual curvilinear function for the relation of supplies to price. The expected price was then estimated on the basis of the multiple regression equation just discussed, and the actual price divided by this estimated price to obtain the index of total demand. Letting $X'_{17} =$ the estimated price, the index of demand, X_{20}, was obtained by the equation

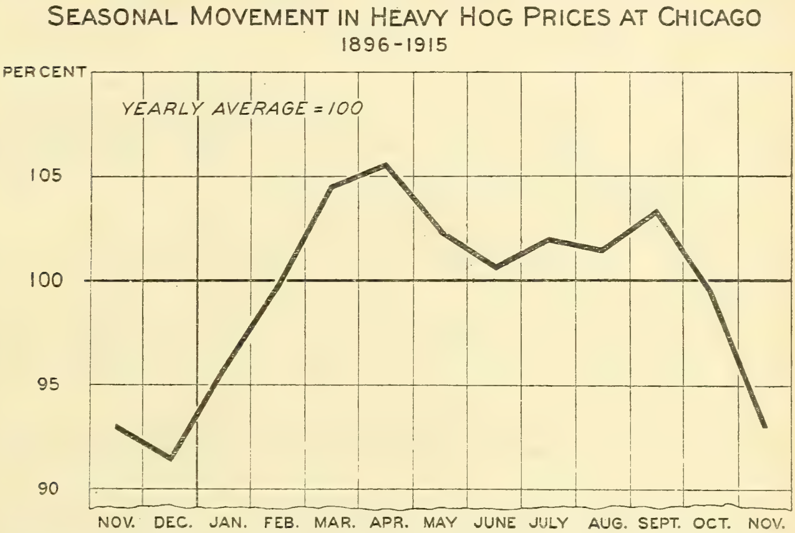

FIG. 28.—Normal seasonal variation in the price of heavy hogs, as determined for the pre-war period. This shows the average variation from month to month, after eliminating the changes due to secular and cyclic variation

$$100\frac{X_{17}}{X'_{17}} = X_{20}$$

The index of total demand thus expresses the percentage which the actual price was of the normal price for the receipts at the time, upon the basis of the linear demand curve.[20]

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[20] Though satisfactory as a rough index, this method of computation is open to criticism on the grounds that only the moving trend of market supply was considered, and that deviations in price due to deviations in supply for a given month from the normal for that month (seasonal allowed for) are left to be reflected in price. For this reason the index is a much better measure of the general trend or level of demand than it is of demand for individual months as such.

Adding X_{20} to the independent variables, a very high correlation with the price was obtained, $R_{17.15,16,20} = 0.998$. This would necessarily be so, since the index of demand was simply the residual from the correlation of X_{15} and X_{16} with X_{17}, expressed as a percentage. This very high correlation therefore has no real significance of itself. As will be shown directly, however, the index of total demand has a multiple correlation of 0.81 with factors which logically should affect demand. This means that 66 per cent of the variation in the index of demand can be accounted for on the basis of other factors. Since the net correlation of X_{20} with X_{17} is necessarily very high—$r_{17,20.15,16} = +0.994$—substituting an index of demand estimated on the basis of the relatonship of the computed index to independent factors would give a correlation with price much above that obtained when no measure of demand was included. If the 66 per cent of the index that could be estimated was as closely related to the price as was all of the original index, a multiple coefficient of about 0.94 would be obtained by correlating receipts, time, and the new index with prices.

RELATIVE IMPORTANCE OF THE VARIOUS FACTORS AFFECTING THE PRICE

Having computed this index to measure the combined effect upon price of all the demand factors, at least in a rough way, the next step was to measure the portion of the variation in hog prices which could be ascribed to the effect of each factor.

The factors considered were:

X_{15} Receipts of hogs at 11 markets, 12 months moving average.
X_{16} Time.
X_{20} The index of total demand.
X_{21} Difference between actual hog prices and hog prices divided by Bureau of Labor Index.
X_{22} Seasonal variation in hog prices times trend in prices minus the trend of prices.
X_{23} The price of heavy hogs, not adjusted in any way.

The figures were taken monthly for the period 1904 to 1915, inclusive.

Variable X_{22} represented that part of the hog prices, in dollars and cents, which could be explained on the basis of the regular seasonal variation in price. Similarly variable X_{21} represented that part of the actual prices which could be explained on the basis of changes in the value of money. And as has been shown, variable X_{20} was a rough measure of the variation in demand factors.

The five independent factors had a multiple correlation with the actual prices of $R = 0.985$. As stated before, this high correlation is not of itself significant, since the index of demand used in this correlation was itself computed from the price. Had the variation in demand been expressed as the absolute difference between the actual price and the computed price, perfect correlation ($R = 1.00$) would necessarily have been obtained, since that would be adding the residual as an independent factor. The failure to obtain this perfect correlation resulted from expressing the difference on a percentage basis. Even leaving out this factor, however, the correlation was $R = 0.904$. The net correlation of the index of demand with the price was 0.918; that is, the index accounted for 84.3 per cent of the variation in price left after eliminating the effect of the other factors.

The following section shows that 65.8 per cent of the variation in the index of total demand can be accounted for by five independent factors. If a demand index computed from these factors were substituted for the demand index based partly on observed prices, at least this 65.8 per cent of the variation accounted for by the original demand index would probably be covered. Since factors other than demand accounted for all but 18.3 per cent $(1-0.904^2)$, of the original price variation, using this second demand index would leave but $1-(0.658\times 0.843)$ times 18.3 per cent or 8.15 per cent of the original price variation unaccounted for. That is, introducing the individual demand factors in the equation in place of the computed index of demand would probably result in a multiple correlation of at least $R=0.958$ $(=\sqrt{1-0.0815})$. This coefficient would be significant, since all of the independent factors concerned would be based on other things than the price itself.

The correlation of the five factors mentioned with price gave a basis for measuring the relative importance of each. The coefficients of determination were as follows:

		Per cent
X_{15}	Trend of market receipts	21. 7
X_{16}	Upward trend of demand	60. 2
X_{20}	Index of total demand	−6. 0
X_{21}	Effect of price level	18. 0
X_{22}	Seasonal variation in price	3. 2
	Total determination by all factors	97. 1

The statements as to the relative importance of the several major forces were based upon this solution. This rests upon the assumption that the index of demand as computed is a true measure of demand, and that hog prices have a 1 to 1 relationship with price level, a change of 25 per cent in price level meaning a change of 25 per cent in hog prices. Obviously neither of these assumptions is necessarily entirely true; but they do serve in this particular case to give some idea of the relative significance of the effects of the different components. Were all the different influences individually represented in a single equation it would be possible to make a more accurate measurement of the importance of each within the limits of the mathematical assumptions implicit in the multiple correlation analysis (*6*).[13]

FACTORS AFFECTING DEMAND

A correlation study was made to determine how closely the index of demand, derived from the price by the method described previously, could be estimated from other factors. The factors taken into account were as follows:

X_4	Storage of pork provisions, adjusted to eliminate normal seasonal variation.
X_5	Index of business cycle.
X_7	Price of steers÷Bureau of Labor Wholesale Price Index.
X_8	Index of European demand.
X_9	Time.
X_{20}	Index of total demand.

Correlating the five factors with X_{20} for the period January, 1904, to December, 1915, a multiple correlation of $R=0.57$ was obtained. Further analysis by curvilinear multiple correlation revealed that several of the regressions were very decidedly curvilinear, and raised the multiple coefficient to P=0.81. Substituting the functional values of the variables for the variables themselves,[20] it was possible to measure the relative importance of each variable by the coefficient of determination. The results were as follows:

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[13] For a nonmathematical discussion of the assumptions which the statistical analysis itself involves, see the first part of the following: EZEKIEL, M., A STATISTICAL EXAMINATION OF FACTORS RELATED TO LAMB PRICES. Jour. Pol. Econ. [now in press].

Determination of demand index by—	Per cent
X_4 Storage stocks	18. 5
X_5 Business cycles	3. 1
X_7 Price of steers	2. 8
X_8 European demand	43. 3
X_9 Trend in time	1. 9
Total determination (R^2)	65. 8

The time factor was included merely to eliminate any trend which failed to be eliminated in the previous computation of the index of demand. This proved to be hardly necessary, as the net regression of the index on time was practically zero, and it was of but little significance as a determining factor. Apparently the growth of demand included in making up the demand curve was about correct.

The statements made in the section on "The demand for hogs" as to the relative importance of each factor were based upon the determination coefficients just listed. It is evident that fluctuations in industrial activity, in so far as they are reflected in the particular index used, are relatively unimportant in affecting the demand for hogs. It must be admitted, however, that this includes stocks in storage as a demand factor, when this really is one resultant of the supply side of the equation. If the demand curve were determined directly from price and quantity consumed, and variations in demand measured from that base, the variations in business activity would probably be shown as a much more important factor affecting variations in demand. In addition, the demand index was determined from a price "deflated" for price level. As shown on page 43, price level changes accounted for 18 per cent of hog price changes. Some part of the changes in the price index is due to the business cycle; so a portion of the variation in hog prices here ascribed to price level changes really is due to the changes in demand accompanying changes in the business activity.

So many assumptions are involved in the train of calculations from the computation of the demand index through this analysis of reasons for its variation that the particular net regression curves obtained are not thought to be of any great significance. They are shown here, however, that the record may be complete (fig. 29).

When stocks were very low, demand increased as stocks began to be larger. In this case probably both changes reflect restored confidence. Then for a time there was only a slight relation. But when stocks became much heavier than 250 million pounds (in terms of normal season stocks) there was a precipitate drop in demand, a further addition of 50 million pounds to storage decreasing demand by 4 per cent.

The curve for the effect of business cycles shows but slight relation between business activity and hog prices when activity is average or below; if anything, the demand is better with rather dull business than with moderately active business. But when business activity increased toward a peak, hog prices suddenly responded, an increase in the index from 110 to 122.5 being accompanied by an increase of nearly 4 per cent in the demand index. Taking into account the fact that the demand index was derived from a "deflated" price, this indicates that hog prices do not fall as sharply in periods of industrial

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[20] See Ezekiel (*5, pp. 445, 446, 448*) for explanation of this process.

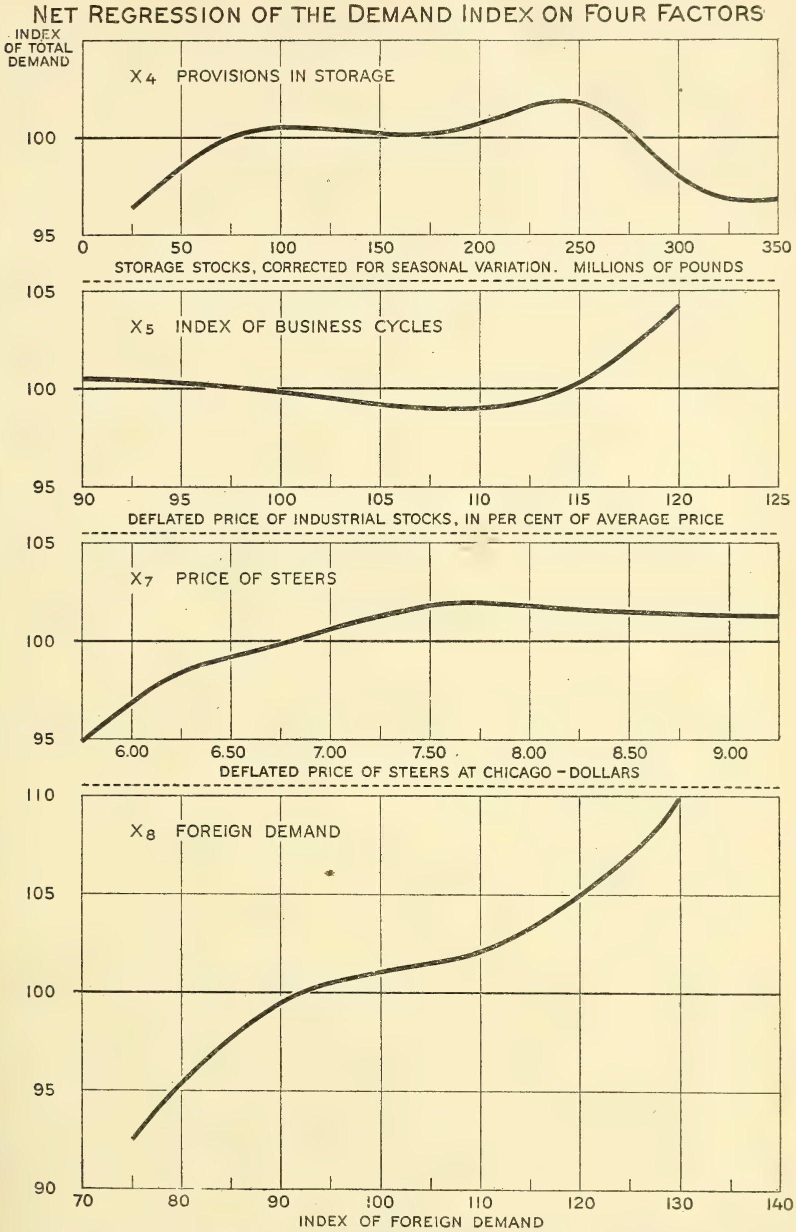

FIG. 29—Net regressions of index of total demand on each of four factors. These curves show the net change in the index of total demand for given changes in each of the factors, the value of the other three factors remaining unchanged

depression as does the average of the commodities represented in the Bureau of Labor wholesale price index (*17*); but that in periods of exceptional business activity hog prices are affected to a greater extent than are the prices of all these commodities.

The curve for steer prices shows that the sensitiveness of hog prices to steer prices varies with the price of steers, an increase in steer prices from $5.75 to $6.25 increasing the hog demand index nearly 4 per cent, whereas an increase from $6.25 to $6.75 increased it less than half as much. Beyond $7.50 further changes in beef prices had no marked effect on hog prices, if anything actually tending to lower them. This offers grounds for some interesting speculations as to the precise relations between substitute products; but it should be borne in mind that with the rather low total correlation (P = 0.81 meaning that only about 66 per cent of total related factors have been measured, and that 34 per cent still remain unaccounted for) not much significance can be attached to minor changes in the curves. This applies also to some of the irregularities in the other curves—they may be due to chance fluctuation or to chance relations to unmeasured forces, rather than to the factor being directly measured.

The curve for foreign demand is about as would be expected on a priori grounds, ignoring the double inflection, which may be due to the same random forces just mentioned. It is interesting, however, to compare this curve with the curve of export demand. (Fig. 27.) The "mirror" similarity suggests that the shape of this curve may have been dependent upon the shape of the export-demand curve, and that better results might have been secured by obtaining the foreign-demand curve by some different method.

FORECASTING PRICES IN TERMS OF DEVIATION FROM TREND

The preliminary study on forecasting prices was made by testing the correlation between the independent factors and the dependent factors at various lags.

The factors considered were:

A. Corn-hog differential.
B. Average live weight of hogs at Chicago.
C. Index of prices of industrial stocks.
C′. Harvard price index of business cycles.
D. Price of corn.
E. Price of hogs.

The corn-hog differential was computed by multiplying the price of corn by 11.42 and subtracting the result from the price of hogs.

The average weight of hogs was adjusted to remove average seasonal variation and then expressed as a percentage of the 39-month moving average, to eliminate the downward trend in weights.

The price of industrial stocks was expressed in percentage of its moving average for a 45-months' period. This moving average showed an upward trend almost identical with the trend in the general price level, so for later work an index of the price of industrial stocks was obtained by dividing the prices of the stocks by the Bureau of Labor all-commodity index of wholesale prices (*17*).

The Harvard Price Index of business cycles, which is published in terms of percentage deviation from trend, was also used as a factor in the preliminary calculations (*19*).

The price of corn was adjusted to remove average seasonal variation and then expressed as a percentage of its 39-month moving average, to eliminate the upward trend.

The price of hogs was divided by the average seasonal variation and then expressed as a percentage deviation from the straight-line trend shown in Figure 21.

The preliminary correlations (using straight-line trends) gave results as follows:

Correlation of hog prices with corn-hog differential

Differential lagged	Period 1903–1915
10 months	−0. 131
12 months	−. 349
14 months	−. 447
16 months	−. 485
17 months	−. 499
18 months	−. 504
19 months	−. 496
20 months	−. 495
21 months	−. 485
22 months	−. 474

Correlation of price of hogs and weight of hogs

Weight lagged	Period 1896–1915	Period 1903–1915
10 months	−0. 384	−0. 406
11 months	−. 387	−. 421
12 months	−. 363	−. 419

Correlation of price of hogs and price of corn

Corn lagged	Period 1896–1915	Period 1903–1915
7 months	+0. 468	+0. 385
9 months	+. 478	+. 504
10 months	+. 462	+. 522
11 months	----------	+. 530
12 months	----------	+. 520

Correlation of price of hogs and price index of business cycles

Price index lagged	Period 1896–1915	Period 1903–1915
1 month	+0. 477	+0. 464
2 months	+. 471	+. 450
3 months	+. 455	+. 571
4 months	+. 424	+. 357
5 months	+. 385	+. 330

Correlation of price of hogs and price of industrial stocks

Stocks lagged	Period 1903–1915
4 months	+0. 452
5 months	+. 464
6 months	[1] +. 462
8 months	+. 410

[1] Excluding four months during 1914, when stock prices were not available.

It was decided to use only the period 1903 to 1915 in making the multiple correlation study, as apparently the relations were closer for the shorter period, possibly because of shifting of relations during the period. The following lengths of lag were selected for each variable from the results just stated, the six-months lag for the index of business cycles (price of industrial stocks) being used so that it would be possible to get a six-months "forecast."

A Corn-hog differential, lagged 18 months.
B Live weight of hogs, lagged 11 months.
C Index of prices of industrial stocks, lagged six months.
D Price of corn, lagged 11 months.
E Price of hogs.

Each factor except A was expressed as a percentage of straight-line trend and corrected for seasonal, as already explained, before being lagged. The multiple correlation of the four factors with E for the period 1903 to 1914 gave a multiple coefficient of $R_{E \cdot ABCD} = 0.651$, for the straight-line regressions. Applying the method of curvilinear multiple correlation, the regression curves shown in Figure 30 were obtained. On the basis of these curves, a multiple correlation index of $P_{E \cdot ABCD} = 0.847$ was obtained. The net correlation indexes of the different factors with hog prices were as follows:

$$\rho_{EA \cdot BCD} = 0.581$$
$$\rho_{ED \cdot ABC} = 0.478$$
$$\rho_{EC \cdot ABD} = 0.499$$
$$\rho_{EB \cdot ACD} = 0.311$$

The relative importance of each of the four factors, as shown by the determination coefficients, was as follows:

	Per cent
A Corn-hog differential	34. 2
B Average live weight	3. 0
C Price index of business cycles	16. 6
D Corn prices	17. 9
Total determination by all four	71. 7

When the hog prices estimated by the use of these results from values of the other four factors available at least six months in advance, were converted back from terms of deviations from the trend to actual prices, there was a correlation of 0.932 between the actual prices and the estimated prices. This correlation was necessarily higher as the result of putting back in the trend and seasonal portion of the hog prices, for which a perfect estimate could be made.

Taking six-month moving averages of both the actual hog prices and those estimated there was a correlation of 0.967 between the smoothed values, showing that the estimated prices correlated with the more general swing of actual prices even more closely than with the prices from month to month.

The closeness of this estimate may be gauged from the fact that the standard deviation of the error in "predicting" the actual monthly price was only 49.5 cents, and between the moving average of the predicted prices and the moving averages of the hog prices, only 34.8 cents.

The net regression curves shown in Figure 30 deserves some comment. It should be remembered that these curves represent not only the effect upon later prices of the particular variable designated, but also the effect of other related variables not taken into account, making their effects felt by way of those of the variables considered with which they are correlated. In addition, the relation between

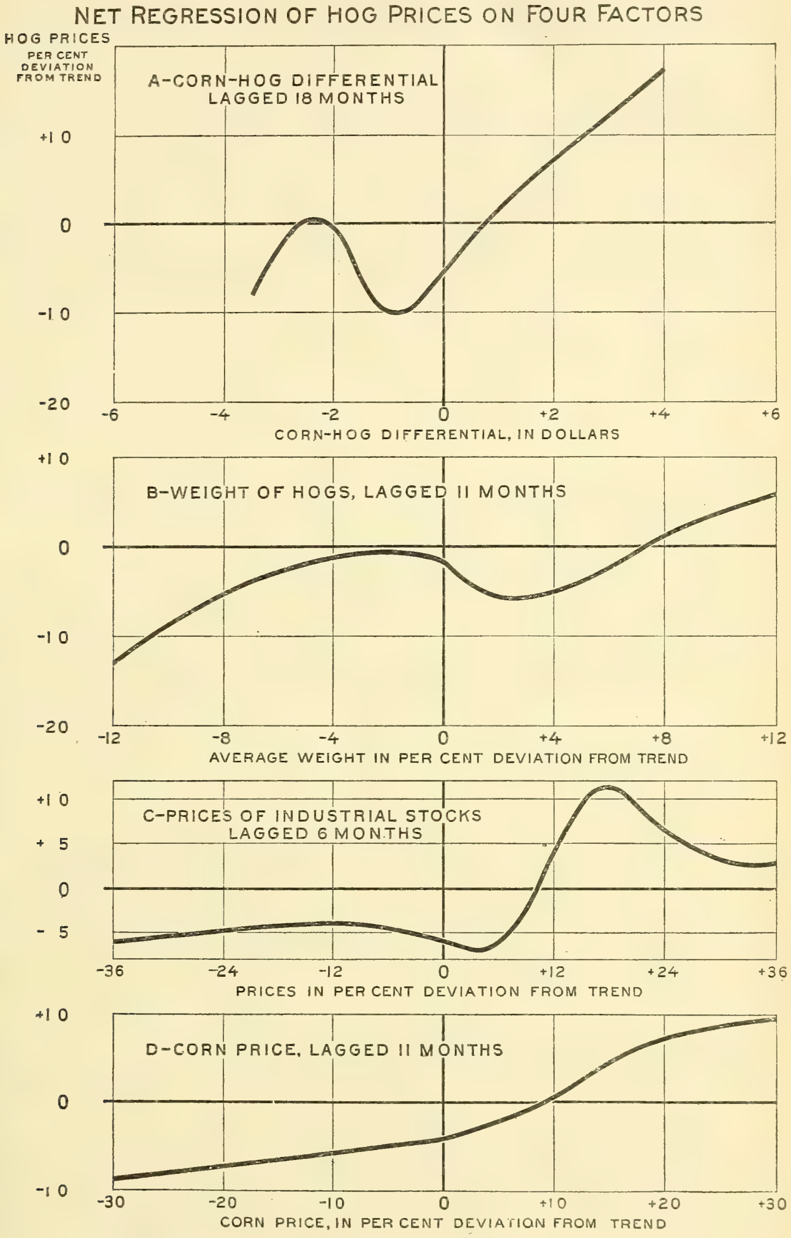

FIG. 30.—Net regression of hog price (in percentage deviations from trend) on four other factors. These curves show the functions used in making the forecast of hog prices

the corn-hog differential at one time, and the resulting price at a later time, is a very complex function between the two almost pure sine-curves which appear when the corn-hog differential and the smoothed price of hogs are graphed. Finally, the effect of the supply of hogs upon the price received is represented in the four regression curves, contributing some part to the shape of each.

The curves are of such shape that three or more constants would be required to state each as an analytical function. That means that the error in determining each such constant by multiple correlation would be higher than simply using four variables would indicate. It may be that some of these peculiarities of shape represent merely particular relationships between the variables during the rather short series of years studied, which had no real causal significance, and which therefore will not be repeated hereafter. Although this is admittedly a possibility, there is no way of testing it out in advance; all that can be said is: "These relations did exist in the past. Barring other forces coming into play, it seems reasonable to expect them to be likely to reoccur in the future."

No attempt is made at this point to give a logical explanation of the significance of each of these curves. The whole body of the previous analysis has developed the nature of the relationships involved; the attempt here is merely to obtain empirically a method of price forecasting, without attempting specific explanations of the functions obtained.

The application of these results to forecasting hog prices under present conditions is limited by three unknown factors.

(1) What is the postwar trend of production?

(2) What is the postwar trend of hog prices?

(3) To what extent will the pig-survey information change the market's reactions?

As has already been developed, the postwar trend of demand has not yet become sufficiently stable to make possible an estimate of its future course. Barring that, question 2 must remain unanswered for the present, and until that question can be answered, question 3 can not be investigated with any degree of accuracy.

FORECASTING THE PRICE OF HOGS BY PERCENTAGE CHANGES

An attempt was made to obtain a "forecasting formula" to fit postwar conditions by using percentage first differences instead of deviations from trend, and so remove the problem of specifically determining trends. Obviously, however, the differences themselves included whatever there was of a regular trend effect.

The following variables were used:

F Corn-hog differential÷Bureau of Labor Index, lagged 18 months.
G Corn-hog differential÷Bureau of Labor Index, lagged 6 months.
H Index of Prices of Industrial Stocks, lagged 6 months.

$$I=\frac{\text{Price of hogs, corrected for normal seasonal variation, then divided by Bureau of Labor Index}}{\text{Moving average of same figure for 18 months previous}}$$

The price of hogs, I, was thus stated as the per cent which the price, adjusted for price level and seasonal variation, was of the moving average of the same price 18 months previously. In other words, the dependent variable was the percentage change in price over an 18-month period.

For the period, June, 1905, to May, 1913, the correlation between the corn-hog differential and this per cent change, r_{FI}, was equal to $+0.85$, and the multiple correlation of the three variables with the dependent, $R_{I \cdot FGH}$, was 0.878. The relative importance as determining factors was as follows:

	Per cent
F Corn-hog differential, 18-month lag	65. 9
G Corn-hog differential, 6-month lag	1. 0
H Industrial stocks, 6-month lag	10. 1
Total determination	77. 0

Besides I, above, a new statement of the dependent variable was computed as follows:

$$K=\frac{\text{12-month moving average of (price of hogs} \div \text{seasonal variation} \div \text{Bureau of Labor Index)}}{\text{Same average, lagged 18 months}}$$

This gave a correlation with the corn-hog differential of $r_{KF}=+0.895$, and a multiple correlation of $R_{K \cdot FGH}=0.937$. The determination coefficients were as follows:

	Per cent
F	76. 5
G	1. 7
H	9. 5
Total	87. 7

That the corn-hog ratio lagged 18 months was the dominant cause of variations in both I and K is evident. This ratio is an expression of factors affecting the number of sows that farmers bred. The index of industrial stocks was next in importance, probably because it gave some slight forecast of changes in consumers' purchasing power and demand. The corn-hog differential with a six-month lag, introduced to measure the effect of corn and hog prices in changing the weight to which the hogs were fattened, was of only negligible importance.

For the period January, 1920, to June, 1924. the following results were obtained:

$$R_{I \cdot FGH}=0.83$$

and

$$R_{K \cdot FGH}=0.79$$

In neither case were these high enough to use for forecasting purposes.

One difficulty with this approach is that before the results can be reduced to actual prices, either the level of prices must be forecasted or it must be assumed to remain unchanged. The seriousness of this limitation is shown by the fact that when prices were estimated for the pre-war period by the correlations with I, and the actual index of prices was used (that is, assuming the level of prices could be predicted six months in advance with perfect accuracy), the correlation between the actual and the predicted prices was +0.91; whereas when prices were estimated using the price index six months earlier (when the prediction was theoretically being made), the correlation was only +0.88. In either case it is evident that the forecasts for the pre-war period were not nearly so accurate as were the forecasts based on deviations from the trends. With further refinement, however, it may ultimately prove the most satisfactory method.

FORECASTING THE PRICE OF HOGS FROM THE FUTURES PRICES FOR HOG PRODUCTS

The price of live hogs is very closely correlated with the price of hog products at the same time. Thus, live hog prices may be rather closely estimated from the price of three products, as shown in Figure 5, the correlation being 0.955. The multiple regression equation by which this chart is drawn, in terms of prices per 100 pounds for each product, is: Heavy hogs$=0.2450$ lard$+0.0479$ mess pork$+0.6504$ short ribs-0.1645.

There is an active futures market for lard and short ribs, with deliveries as far as five months in the future. Prices are quoted for delivery only in four months, January, May, July, and September for lard. That gives some basis for making at least a quarterly prediction of the price.

Although there is a high correlation between future quotations and the final price for each product, much of that correlation is due to general trends. Thus for the period 1896 to 1915 the correlation between lard futures for delivery in five months and the average price for the delivery month was +0.893. Taking first differences, however, for the change in price in five months, the correlation was only 0.290.

For the period 1896 to 1915 the future prices of short ribs and lard for delivery in five months were correlated with the average price of heavy hogs for the delivery month, giving a multiple correlation of $R=0.879$. For the period 1916 to 1924 the same factors gave a multiple correlation of $R=0.886$. In both cases, especially the latter, the largest part of this correlation was due to the inclusion of the similar movements in trends in both actual and estimated values. It is probable that the correlation for 1916 to 1924 would drop to an insignificant value if computed as first differences instead.

The net regression equation (from the pre-war solution) used in constructing Figure 23, is as follows:

Letting $Y=$quotation for short ribs for delivery in five months,
$Z=$quotation for lard for delivery in five months, and
$P=$forecasted price of heavy hogs for five months later.

$$P=0.0439Y+0.6256Z+0.668.$$

The relative accuracy of these five-month forecasts, as compared with the six-month forecasts from the correlation with corn-hog differential, etc., on page 48, may be judged from the square of the standard errors of estimate,[21] which are 0.215 for the former, and 0.131 for the latter. Since the accuracy of estimate varies inversely with this coefficient, it is evident that the latter method was nearly twice as accurate as the former for the period under consideration.[22]

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[21] The standard error of estimate, e, may be computed by the equation

$$e^2=(1-R^2)\sigma^2_x$$

where x is the dependent variable. In percentage terms, the square of the standard error represents the part of the variation still unaccounted for—the difference beteen 100 per cent and the total determination by all factors measured.

[22] For a method of estimating hog receipts directly from prices, weather conditions, and similar factors, see ELLIOTT, F. F., ADJUSTING HOG PRODUCTION TO MARKET DEMAND. [Unpublished manuscript in the files of the Bureau of Agricultural Economics.]

SUMMARY

The returns to the producers of hogs depend to a considerable extent upon how well they adjust the volume of their production to the demand for the product. They can make the best adjustment only if they can reach a sound conclusion as to the future developments in the hog market. Clear understanding of the forces which affect the market price is a prerequisite to reaching such conclusions.

The dominant influences in the hog market, as shown by this study, are (1) the supply of hogs on the market and expected to arrive on the market within the next few months, (2) the quantity of hog products in storage, (3) the general price level, (4) general business conditions, and (5) the prices of alternative products. The general levels of demand, both here and abroad, are both important, but ordinarily change only slowly.

The "hog-price cycle" was found to be due to the tendency of hog producers to overshoot the mark in increasing production when the relation of hog prices to corn prices was favorable and to reduce too much when it was unfavorable. This excessive reaction resulted from the accumulation of production changes during the interval before reduced or increased breeding began to offset market receipts and prices.

Coupling the corn-hog ratio, indicating what changes were likely to occur in breeding, with other factors indicating changes in the weight of hogs and the demands of the consumers, very good forecasts of hog prices could have been made for the pre-war period. Since the war, however, conditions have been so unstable that the purely mathematical formula has not given such satisfactory results.

At the same time the pig survey has provided the hog market with much better information as to the prospective supplies than were available before the World War, while the agricultural outlook reports of the Department of Agriculture and similar information from other sources may be tending to change farmers' reactions. Further studies would be necessary to determine how far the pre-war relations, presented in this bulletin, are applicable to the changed conditions.

APPENDIX

TABLE 1.—*Data used in the statistical analysis*

	Monthly supply of hogs						Prices at Chicago						
Year and month	Receipts of hogs at 11 markets[1]	Monthly slaughter under Federal inspection			Average live weight of hogs at Chicago[4]	Stocks of provisions at Chicago[5]	Average price of heavy hogs, per 100 lbs.[6]	Average price of corn, per bu.[7]	Quotations for delivery in five months[8]		Lard, per 100 lbs.[9]	Short ribs, per 100 lbs.[9]	Mess pork, per bbl.[9]
		Number[2]	Live wt.[3]	Dressed weight (pork and lard)[3]					Short ribs, per 100 lbs.	Lard, per 100 lbs.			
1896	*Thousands*	*Thousands*	*Lbs.*	*Lbs.*	*Lbs.*	*1,000 pounds*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*
January	------	------	------	------	236	182, 815	3. 95	0. 27	------	------	5. 56	4. 75	8. 84
February	------	------	------	------	239	195, 896	4. 10	. 28	5. 38	5. 82	5. 52	5. 18	10. 08
March	------	------	------	------	246	217, 623	3. 90	. 29	------	------	5. 20	4. 88	9. 05
April	------	------	------	------	243	240, 565	3. 55	. 30	------	------	4. 87	4. 35	8. 40
May	------	------	------	------	243	265, 730	3. 30	. 29	------	------	4. 45	4. 00	7. 52
June	------	------	------	------	249	289, 465	3. 15	. 27	------	------	4. 06	3. 78	7. 02
July	------	------	------	------	249	280, 448	3. 05	. 26	------	------	3. 48	3. 38	6. 42
August	------	------	------	------	253	227, 806	3. 05	. 23	3. 54	3. 70	3. 30	3. 38	6. 35
September	------	------	------	------	257	188, 243	2. 90	. 21	------	------	3. 50	3. 32	5. 85
October	------	------	------	------	242	159, 194	3. 25	. 24	------	------	4. 20	3. 68	6. 92
November	------	------	------	------	245	144, 877	3. 25	. 24	------	------	4. 00	3. 78	6. 75
December	------	------	------	------	254	199, 956	3. 25	. 23	4. 01	4. 09	3. 82	3. 85	6. 75
1897													
January	------	------	------	------	247	242, 448	3. 25	. 23	------	------	3. 92	3. 94	7. 78
February	------	------	------	------	238	260, 431	3. 35	. 23	4. 10	4. 01	3. 84	3. 96	7. 72
March	------	------	------	------	230	260, 255	3. 85	. 24	------	------	4. 10	4. 02	8. 42
April	------	------	------	------	235	248, 964	4. 05	. 24	------	4. 34	4. 15	4. 60	8. 32
May	------	------	------	------	237	268, 443	3. 75	. 24	------	------	3. 84	4. 52	8. 32
June	------	------	------	------	240	293, 799	3. 40	. 24	------	------	3. 78	4. 40	7. 62
July	------	------	------	------	238	271, 779	3. 50	. 26	------	------	4. 05	4. 45	7. 68
August	------	------	------	------	249	244, 224	3. 90	. 30	3. 54	------	4. 52	5. 22	8. 32
September	------	------	------	------	252	207, 280	4. 00	. 30	------	------	4. 62	5. 35	8. 52
October	------	------	------	------	244	181, 196	3. 75	. 27	------	------	4. 34	4. 78	7. 85
November	------	------	------	------	252	186, 245	3. 40	. 27	------	------	4. 24	4. 05	7. 35
December	------	------	------	------	245	217, 126	3. 35	. 26	4. 49	4. 64	4. 46	4. 45	7. 56
1898													
January	------	------	------	------	233	246, 745	3. 65	. 27	------	------	4. 74	4. 75	9. 50
February	------	------	------	------	227	262, 862	4. 00	. 29	5. 18	5. 14	5. 00	5. 08	10. 45
March	------	------	------	------	220	252, 006	3. 90	. 29	------	------	5. 04	5. 06	10. 00
April	------	------	------	------	223	239, 823	3. 90	. 32	5. 50	5. 64	5. 42	5. 38	10. 45
May	------	------	------	------	225	244, 682	4. 35	. 35	------	------	6. 28	6. 00	11. 52
June	------	------	------	------	229	270, 420	4. 10	. 32	------	------	5. 78	5. 65	10. 30
July	------	------	------	------	232	275, 729	3. 95	. 34	------	------	5. 42	5. 50	9. 67
August	------	------	------	------	243	234, 249	3. 90	. 32	------	------	5. 20	5. 32	9. 00
September	------	------	------	------	246	191, 166	3. 85	. 30	------	------	4. 88	5. 25	8. 42
October	------	------	------	------	246	161, 591	3. 70	. 31	------	------	4. 88	5. 20	7. 88
November	------	------	------	------	235	177, 549	3. 45	. 33	------	------	4. 96	4. 88	7. 90
December	------	------	------	------	239	247, 525	3. 40	. 36	4. 99	5. 55	5. 25	4. 78	8. 45

[1] Data for 1904 compiled from Minneapolis Daily Market Record, weekly reports, Jan.–Nov. 26, 1904, and National Provisioner, weekly, Dec. 17, 1904–Jan. 7, 1905. Data for 1905–1925 from Chicago Daily Drovers' Journal Yearbooks, 1906–1925. 1905–1909 combined weekly receipts; 1910–1925, monthly.

[2] Compiled from office records of Division of Livestock, Meats, and Wool, as reported by the Bureau of Animal Industry, 1907–1925.

[3] Compiled from office records of Division of Livestock, Meats, and Wool, 1910–1925.

[4] Chicago Daily Drovers' Journal Yearbooks, 1903–1925.

[5] Cincinnati Price-Current, monthly reports, 1896–1913. Price Current-Grain Reporter, monthly reports, 1914–1925.

[6] Data for 1896–1915 from Agricultural Prices by Henry A. Wallace (*28*); for 1916-1922 from Chicago Daily Drovers' Journal Yearbooks; for 1923–1925 from office records of Livestock, Meats and Wool Division.

[7] Data for 1896–1915 from Agricultural Prices by Henry A. Wallace (*28*), No. 2 mixed; for 1916–1923 from annual reports of the Chicago Board of Trade (*2*), No. 2 contract, spot yellow; for 1924–1925 from office records of the Division of Statistical and Historical Research, weighted average price, No. 2 yellow.

[8] Chicago Board of Trade (*2*), monthly reports, 1896–1924. Chicago Daily Trade Bulletin, 1925.

[9] Cincinnati Price-Current, Jan., 1896–Dec., 1913. Price Current-Grain Reporter, Jan., 1914–1925, except prices for short ribs, 1916–1923, from Chicago Board of Trade prices as quoted by Howard, Bartels & Co., in Chicago Daily Trade Bulletin.

TABLE 1.—*Data used in the statistical analysis*—Continued

Year and month	Monthly supply of hogs						Prices at Chicago						
	Receipts of hogs at 11 markets	Monthly slaughter under Federal inspection			Average live weight of hogs at Chicago	Stocks of provisions at Chicago	Average price of heavy hogs, per 100 lbs.	Average price of corn, per bu.	Quotations for delivery in five months		Lard, per 100 lbs.	Short ribs, per 100 lbs.	Mess pork, per bbl.
		Number	Live wt.	Dressed weight (pork and lard)					Short ribs, per 100 lbs.	Lard, per 100 lbs.			
	Thousands	*Thousands*	*Lbs.*	*Lbs.*	*Lbs.*	*1,000 pounds*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*
1899													
January	------	------	------	------	231	302, 522	3. 75	. 37	------	------	5. 61	4. 95	10. 08
February	------	------	------	------	229	302, 873	3. 80	. 35	5. 08	5. 71	5. 41	4. 75	9. 72
March	------	------	------	------	232	285, 176	3. 80	. 35	------	------	5. 25	4. 62	9. 05
April	------	------	------	------	231	266, 332	3. 85	. 35	4. 96	------	5. 21	4. 65	9. 58
May	------	------	------	------	232	260, 200	3. 90	. 33	------	------	5. 05	4. 60	8. 35
June	------	------	------	------	236	279, 357	3. 80	. 34	------	------	5. 00	4. 65	8. 14
July	------	------	------	------	237	272, 947	4. 25	. 33	------	------	5. 28	4. 92	8. 68
August	------	------	------	------	244	232, 055	4. 55	. 32	4. 92	5. 49	5. 30	5. 02	8. 38
September	------	------	------	------	250	185, 485	4. 40	. 33	------	------	5. 34	5. 22	8. 08
October	------	------	------	------	240	141, 398	4. 30	. 32	------	------	5. 40	5. 02	8. 05
November	------	------	------	------	250	132, 527	3. 90	. 32	------	------	5. 08	5. 00	8. 12
December	------	------	------	------	243	162, 829	4. 05	. 31	5. 35	5. 58	5. 36	5. 15	8. 58
1900													
January	------	------	------	------	229	192, 263	4. 55	. 31	------	------	5. 88	5. 68	10. 62
February	------	------	------	------	226	205, 861	4. 90	. 33	5. 96	6. 06	5. 86	5. 88	10. 80
March	------	------	------	------	223	193, 304	5. 00	. 36	------	------	6. 12	6. 28	11. 62
April	------	------	------	------	223	181, 431	5. 55	. 40	6. 94	7. 09	6. 90	6. 98	12. 85
May	------	------	------	------	228	181, 360	5. 30	. 38	------	------	6. 90	6. 62	11. 65
June	------	------	------	------	229	188, 810	5. 20	. 40	------	------	6. 77	6. 80	11. 95
July	------	------	------	------	236	168, 168	5. 25	. 42	------	------	6. 75	6. 80	12. 15
August	------	------	------	------	246	148, 116	5. 20	. 39	5. 90	6. 54	6. 75	7. 08	11. 55
September	------	------	------	------	247	105, 865	5. 25	. 41	------	------	6. 94	7. 70	11. 58
October	------	------	------	------	234	91, 873	4. 80	. 39	------	------	7. 08	7. 38	13. 75
November	------	------	------	------	240	99, 514	4. 80	. 42	------	------	7. 05	7. 12	10. 94
December	------	------	------	------	238	137, 036	4. 75	. 38	6. 44	6. 96	6. 98	6. 62	11. 31
1901													
January	------	------	------	------	227	158, 504	5. 25	. 37	------	------	7. 20	6. 85	13. 80
February	------	------	------	------	222	179, 752	5. 40	. 39	------	------	7. 44	7. 08	13. 96
March	------	------	------	------	222	167, 820	5. 90	. 42	------	------	7. 85	7. 55	15. 35
April	------	------	------	------	226	147, 112	5. 85	. 45	7. 52	8. 14	8. 36	8. 20	14. 88
May	------	------	------	------	227	166, 942	5. 80	. 51	------	------	8. 08	8. 10	14. 82
June	------	------	------	------	231	173, 166	6. 00	. 43	------	------	8. 48	8. 00	14. 70
July	------	------	------	------	229	153, 600	5. 90	. 51	------	------	8. 55	7. 92	14. 17
August	------	------	------	------	238	148, 996	5. 95	. 57	7. 87	8. 78	8. 76	8. 08	14. 10
September	------	------	------	------	248	109, 972	6. 65	. 57	------	------	9. 60	8. 70	14. 70
October	------	------	------	------	236	101, 378	6. 10	. 56	------	------	9. 28	8. 38	14. 02
November	------	------	------	------	218	123, 255	5. 70	. 61	------	------	9. 04	8. 10	14. 40
December	------	------	------	------	202	173, 099	6. 20	. 65	8. 68	9. 81	9. 76	8. 42	15. 60
1902													
January	------	------	------	------	203	193, 803	6. 40	. 61	------	------	9. 58	8. 34	16. 25
February	------	------	------	------	208	211, 341	6. 30	. 59	9. 54	9. 48	9. 24	8. 38	15. 42
March	------	------	------	------	216	199, 638	6. 50	. 59	------	------	9. 44	8. 50	15. 82
April	------	------	------	------	214	167, 861	7. 10	. 61	9. 78	9. 95	9. 76	9. 10	16. 65
May	------	------	------	------	219	156, 571	7. 00	. 62	------	------	10. 24	9. 62	17. 12
June	------	------	------	------	223	155, 882	7. 50	. 66	------	------	10. 37	10. 35	17. 82
July	------	------	------	------	230	138. 379	7. 80	. 72	------	------	10. 91	10. 45	17. 72
August	------	------	------	------	243	114, 262	7. 25	. 57	7. 78	8. 51	10. 44	9. 98	16. 45
September	------	------	------	------	241	88, 704	7. 55	. 60	------	------	10. 98	10. 80	16. 48
October	------	------	------	------	227	59, 032	7. 00	. 58	------	------	10. 78	11. 38	17. 00
November	------	------	------	------	224	73, 728	6. 35	. 55	------	------	10. 81	9. 87	16. 75
December	------	------	------	------	217	108, 702	6. 35	. 51	8. 32	9. 21	10. 50	8. 68	16. 94
1903													
January	------	------	------	------	208	127, 340	6. 60	. 46	------	------	9. 95	8. 78	17. 35
February	------	------	------	------	209	139, 832	7. 00	. 44	9. 25	9. 36	9. 52	9. 35	17. 22
March	------	------	------	------	215	130, 420	7. 45	. 44	------	------	9. 95	9. 70	17. 85
April	------	------	------	------	222	130, 454	7. 30	. 44	9. 51	9. 57	9. 60	9. 62	17. 68
May	------	------	------	------	227	134, 615	6. 60	. 45	------	------	8. 98	9. 30	17. 68
June	------	------	------	------	231	147, 921	6. 05	. 50	------	------	8. 48	8. 98	16. 44
July	------	------	------	------	235	159, 531	5. 45	. 51	------	------	7. 92	8. 20	14. 50
August	------	------	------	------	248	157, 880	5. 30	. 52	6. 68	7. 10	8. 06	7. 50	12. 60
September	------	------	------	------	257	132, 263	5. 75	. 49	------	------	9. 75	8. 25	12. 62
October	------	------	------	------	241	104, 322	5. 40	. 45	------	------	7. 16	8. 12	11. 28
November	------	------	------	------	228	94, 098	4. 60	. 43	------	------	6. 72	7. 00	11. 31
December	------	------	------	------	219	138, 832	4. 50	. 42	6. 35	6. 74	6. 58	6. 31	11. 88

TABLE 1.—*Data used in the statistical analysis*—Continued

Year and month	Monthly supply of hogs						Prices at Chicago						
	Receipts of hogs at 11 markets	Monthly slaughter under Federal inspection			Average live weight of hogs at Chicago	Stocks of provisions at Chicago	Average price of heavy hogs, per 100 lbs.	Average price of corn, per bu.	Quotations for delivery in five months		Lard, per 100 lbs.	Short ribs, per 100 lbs.	Mess pork, per bbl.
		Number	Live wt.	Dressed weight (pork and lard)					Short ribs, per 100 lbs.	Lard, per 100 lbs.			
1904	*Thousands*	*Thousands*	*Lbs.*	*Lbs.*	*Lbs.*	*1,000 pounds*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*
January	2,251	------	------	------	206	151,867	4.95	.45	------	------	6.92	6.44	13.06
February	2,086	------	------	------	205	189,684	5.25	.50	7.44	7.80	7.48	7.12	14.68
March	1,861	------	------	------	206	199,579	5.50	.53	------	------	7.01	6.94	13.81
April	1,547	------	------	------	208	190,677	5.15	.51	6.68	6.91	6.70	6.44	12.48
May	1,727	------	------	------	214	193,767	4.75	.49	------	------	6.38	6.38	11.28
June	2,164	------	------	------	221	199,627	5.05	.49	------	------	6.68	7.06	12.20
July	1,060	------	------	------	226	193,856	5.35	.49	------	------	6.95	7.37	12.90
August	1,399	------	------	------	239	170,151	5.25	.54	6.74	6.95	6.81	7.41	12.00
September	1,466	------	------	------	244	120,400	5.70	.53	------	------	7.24	7.56	11.20
October	1,403	------	------	------	230	82,832	5.35	.54	------	------	7.44	7.56	11.28
November	1,927	------	------	------	232	85,761	4.80	.54	------	------	7.04	6.87	11.25
December	3,029	------	------	------	228	147,816	4.50	.46	6.87	7.12	6.86	6.44	11.34
1905													
January	2,469	------	------	------	213	183,774	4.70	.43	------	------	6.72	6.44	12.51
February	2,052	------	------	------	209	214,482	4.90	.44	6.92	7.05	6.76	6.62	12.58
March	2,175	------	------	------	211	223,284	5.20	.47	------	------	6.94	6.62	12.68
April	1,595	------	------	------	216	215,556	5.45	.48	7.42	7.51	7.12	6.94	12.32
May	2,248	------	------	------	219	216,084	5.40	.56	------	------	7.14	7.06	12.18
June	2,155	------	------	------	222	225,163	5.30	.54	------	------	7.24	7.56	12.62
July	1,540	------	------	------	228	200,804	5.60	.56	------	------	7.12	7.80	12.95
August	1,690	------	------	------	236	163,766	5.90	.55	6.74	7.20	7.68	8.50	14.52
September	1,356	------	------	------	241	124,526	5.40	.53	------	------	7.57	8.58	15.56
October	1,658	------	------	------	234	97,677	5.10	.52	------	------	7.14	8.00	15.38
November	2,625	------	------	------	230	93,979	4.80	.49	------	------	7.14	7.15	13.82
December	2,282	------	------	------	221	114,598	4.90	.46	7.24	7.40	7.52	7.04	13.12
1906													
January	2,218	------	------	------	217	134,893	5.40	.42	------	------	7.47	7.32	13.71
February	2,060	------	------	------	215	146,338	6.00	.41	8.00	7.86	7.62	7.75	14.70
March	2,138	------	------	------	218	139,520	6.30	.42	------	------	8.04	8.35	15.78
April	1,568	------	------	------	221	138,888	6.50	.46	8.81	8.81	8.54	8.62	15.92
May	2,310	------	------	------	226	138,758	6.45	.49	------	------	8.56	8.88	15.55
June	2,069	------	------	------	226	158,538	6.55	.52	------	------	8.67	9.22	16.75
July	1,669	------	------	------	231	151,477	6.60	.49	------	------	8.86	9.30	18.50
August	2,016	------	------	------	241	142,380	6.15	.51	8.38	8.01	8.70	8.90	17.08
September	1,393	------	------	------	248	112,744	6.15	.50	------	------	8.76	8.82	16.78
October	1,489	------	------	------	237	79,425	6.40	.49	------	------	9.31	8.62	16.50
November	2,198	------	------	------	229	82,769	6.20	.46	------	------	9.44	8.38	15.50
December	2,021	------	------	------	225	102,770	6.25	.46	8.46	8.96	8.98	8.44	15.18
1907													
January	2,150	3,410	------	------	223	113,271	6.60	.42	------	------	9.40	9.00	16.40
February	2,130	2,921	------	------	222	135,190	7.05	.44	9.51	9.94	9.72	9.31	17.08
March	2,166	2,665	------	------	228	138,401	6.65	.44	------	------	9.02	8.68	16.12
April	1,691	2,667	------	------	234	130,470	6.60	.48	8.84	9.01	8.74	8.48	16.06
May	2,595	3,317	------	------	235	173,208	6.35	.53	------	------	9.00	8.74	16.31
June	2,223	3,240	------	------	236	203,590	6.05	.53	------	------	8.78	8.50	15.90
July	1,988	2,929	------	------	240	201,276	5.09	.54	------	------	8.94	8.56	16.20
August	2,058	2,301	------	------	250	171,715	5.90	.58	8.01	8.68	8.94	8.61	15.92
September	1,489	1,988	------	------	253	150,863	5.80	.62	------	------	8.96	8.30	14.70
October	1,488	2,219	------	------	235	105,644	6.05	.61	------	------	8.88	8.06	14.38
November	1,765	2,135	------	------	209	81,392	4.90	.58	------	------	8.06	7.25	12.50
December	2,216	3,094	------	------	214	96,712	4.65	.60	6.98	7.84	7.95	7.00	12.06
1908													
January	3,383	4,961	------	------	215	159,125	4.45	.59	------	------	7.76	6.80	12.50
February	2,671	3,890	------	------	212	197,123	4.50	.58	6.76	7.64	7.22	5.95	11.25
March	2,092	3,111	------	------	212	218,551	5.05	.62	------	------	7.92	6.35	12.55
April	2,010	2,304	------	------	219	205,567	5.85	.67	7.61	8.60	8.14	6.60	13.21
May	2,126	3,088	------	------	218	216,117	5.50	.75	------	------	8.38	6.95	13.40
June	2,078	3,094	------	------	217	226,655	5.80	.71	------	------	8.82	7.70	14.22
July	2,021	2,416	------	------	222	216,361	6.55	.74	------	------	9.34	8.70	15.61
August	1,526	2,231	------	------	224	180,587	6.60	.79	8.30	9.15	9.34	8.70	14.98
September	1,778	2,231	------	------	219	115,430	6.90	.80	------	------	9.94	9.85	15.18
October	2,069	3,368	------	------	207	86,331	6.05	.73	------	------	9.78	9.05	14.18
November	2,576	3,803	------	------	213	109,038	5.90	.64	------	------	9.34	8.50	14.68
December	2,916	4,167	------	------	211	149,461	5.75	.60	8.58	9.55	9.31	8.05	14.62

TABLE 1.—*Data used in the statistical analysis*—Continued

Year and month	Monthly supply of hogs						Prices at Chicago						
	Receipts of hogs at 11 markets	Monthly slaughter under Federal inspection			Average live weight of hogs at Chicago	Stocks of provisions at Chicago	Average price of heavy hogs, per 100 lbs	Average price of corn, per bu.	Quotations for delivery in five months		Lard, per 100 lbs.	Short ribs, per 100 lbs.	Mess pork, per bbl.
		Number	Live wt.	Dressed weight (pork and lard)					Short ribs, per 100 lbs.	Lard, per 100 lbs.			
	Thousands	*Thousands*	*Lbs.*	*Lbs.*	*Lbs.*	*1,000 pounds*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*
1909													
January	2,574	3,876	------	------	203	187,658	6.20	.60	------	------	9.58	8.37	16,88
February	2,020	2,653	------	------	204	188,660	6.45	.63	9.05	9.78	9.50	8.56	16.87
March	2,033	3,013	------	------	206	204,801	6.80	.66	------	------	9.98	8.81	17.38
April	2,049	2,343	------	------	212	184,560	7.30	.70	9.74	10.48	10.18	9.30	17.90
May	1,855	2,629	------	------	216	176,129	7.40	.74	------	------	10.61	10.06	18.40
June	1,763	2,719	------	------	219	166,031	7.80	.74	------	------	11.51	10.80	20.06
July	1,754	2,097	------	------	225	143,336	7.90	.71	------	------	11.36	11.18	20.58
August	1,209	1,822	------	------	232	108,788	7.60	.68	9.02	10.08	11.71	11.30	21.46
September	1,538	1,955	------	------	232	71,799	8.10	.66	------	------	12.26	11.80	23.98
October	1,462	2,397	------	------	227	44,551	7.85	.61	------	------	12.32	11.10	23.88
November	1,768	2,800	------	------	225	55,333	8.10	.63	------	------	13.02	11.31	23.88
December	2,313	3,090	------	------	214	83,035	8.45	.64	11.12	11.78	13.02	12.28	23.00
1910													
January	1,929	2,693	208	160.9	210	93,398	8.70	.65	------	------	11.80	11.11	21.38
February	1,745	2,324	208	160.9	213	97,838	9.20	.65	12.24	12.54	12.58	12.12	23.12
March	1,447	1,891	213	164.0	218	88,610	10.65	.63	------	------	14.00	13.16	25.75
April	1,274	1,778	218	167.8	227	84,656	10.00	.59	12.45	12.66	13.00	12.62	23.20
May	1,660	2,206	229	176.3	239	95,652	9.50	.60	------	------	12.55	12.06	22.62
June	1,883	2,612	233	178.8	242	116,448	9.35	.59	------	------	12.16	13.00	22.75
July	1,532	1,988	231	176.6	246	112,416	8.60	.63	------	------	11.91	11.37	25.50
August	1,461	1,824	241	183.5	255	106,173	8.25	.63	9.51	10.45	11.81	11.81	22.75
September	1,256	1,564	247	187.3	259	74,972	8.70	.55	------	------	12.40	11.50	20.00
October	1,579	1,851	242	182.2	253	65,282	8.45	.50	------	------	12.82	10.88	18.00
November	1,795	2,456	230	174.9	232	67,708	7.75	.50	------	------	10.78	9.94	17.50
December	1,962	2,827	225	172.3	224	83,195	7.65	.48	9.54	10.04	10.34	9.88	18.50
1911													
January	2,036	2,742	223	172.4	226	91,297	7.85	.47	------	------	10.24	10.31	20.38
February	1,923	2,633	228	176.3	230	113,277	7.25	.47	9.38	9.41	9.44	9.68	20.38
March	2,169	2,973	234	180.1	239	149,630	6.70	.47	------	------	8.70	8.75	17.75
April	1,876	2,589	233	179.4	241	157,189	6.15	.50	8.05	8.18	7.94	8.00	16.00
May	2,266	3 008	228	175.5	242	168,942	5.85	.54	------	------	8.06	7.68	16.12
June	2,416	3,462	222	170.4	236	197,342	6.15	.56	------	------	8.15	7.94	15.43
July	1,855	2,560	219	167.4	233	201,931	6.65	.63	------	------	8.36	8.12	16.56
August	1,600	2,032	228	173.6	239	159,965	7.15	.64	8.36	8.81	8.96	8.56	17.12
September	1,560	2,172	220	166.9	224	115,578	6.75	.67	------	------	9.27	8.62	15.31
October	2,021	2,720	206	155.1	212	94,769	6.50	.72	------	------	8.91	8.31	15.25
November	2,632	3,639	200	152.1	208	112,130	6.35	.73	------	------	9.10	8.18	16.06
December	2,445	3,603	201	153.9	213	141,932	6.25	.70	8.55	9.31	8.98	8.18	15.62
1912													
January	3,084	4,147	201	155.4	212	186,440	6.30	.67	------	------	9.25	8.06	15.50
February	2,631	3,302	209	161.6	217	219,516	6.25	.65	8.74	9.31	8.90	8.08	15.44
March	2,165	2,700	209	160.9	218	225,006	7.10	.70	------	------	9.35	8.68	16.18
April	1,969	2,412	218	167.8	227	225,120	7.85	.78	10.32	10.85	10.36	9.62	18,24
May	2,133	2,844	224	172.4	232	228,271	7.70	.79	------	------	10.64	10.06	18.75
June	2,082	2,835	226	173.5	235	247,231	7.50	.74	------	------	10.77	10.18	18.68
July	1,840	2,354	225	172.0	239	239,918	7.60	.72	------	------	10.56	10.24	18.00
August	1,462	1,875	228	173.6	240	191,292	8.05	.78	9.98	10.10	10.80	10.62	17.78
September	1,343	1,701	227	172.2	235	162,109	8.30	.74	------	------	11.02	10.62	17.18
October	1,875	2,455	216	162.6	226	75,741	8.65	.64	------	------	11.34	10.62	16.94
November	2,107	3,020	217	165.0	222	64,868	7.75	.54	------	------	11.05	10.62	18.12
December	2,404	3,407	217	166.2	223	94,736	7.45	.51	9.81	9.98	10.52	9.75	17.00
1913													
January	2,632	3,708	222	171.7	226	121,523	7.40	.49	------	------	9.88	10.20	18.38
February	2,027	2,844	221	170.9	230	137,113	8.05	.50	10.45	10.50	10.42	10.24	19.74
March	1,775	2,334	227	174.7	240	136,154	8.75	.52	------	------	10.32	10.81	20.37
April	1,843	2,487	229	176.3	242	125,968	8.80	.56	10.88	10.94	10.96	11.25	20.06
May	2,105	3,046	230	177.0	242	228,271	8.40	.58	------	------	11.06	11.94	20.17
June	2,225	3,057	232	178.1	244	169,784	8.50	.61	------	------	11.03	11.88	20.88
July	1,959	2,557	232	177.3	243	185,451	8.95	.64	------	------	11.51	11.81	21.94
August	1,771	2,268	226	172.1	233	172,223	8.10	.73	10.08	10.68	11.24	14.25	21.94
September	1,753	2,133	218	165.3	222	141,882	8.10	.75	------	------	11.15	11.38	22.12
October	2,032	2,681	206	155.1	209	96,048	8.15	.70	------	------	10.64	10.94	21.25
November	2,248	3,165	200	152.1	207	90,100	7.80	.73	------	------	10.72	10.81	20.88
December	2,815	3,919	209	160.0	213	125,593	7.70	.70	11.11	11.04	10.64	10.94	21.00

TABLE 1.—*Data used in the statistical analysis*—Continued

Year and month	Monthly supply of hogs						Prices at Chicago						
	Receipts of hogs at 11 markets	Monthly slaughter under Federal inspection			Average live weight of hogs at Chicago	Stocks of provisions at Chicago	Average price of heavy hogs, per 100 lbs.	Average price of corn, per bu.	Quotations for delivery in five months		Lard, per 100 lbs.	Short ribs, per 100 lbs.	Mess pork, per bbl.
		Number	Live wt.	Dressed weight (pork and lard)					Short ribs, per 100 lbs.	Lard, per 100 lbs.			
1914	*Thousands*	*Thousands*	*Lbs.*	*Lbs.*	*Lbs.*	*1,000 pounds*	*Dols*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*
January	2,479	3,489	206	159.3	216	159,433	8.35	.63	------	------	10.90	10.98	21.25
February	2,030	2,723	214	165.5	224	176,938	8.55	.62	11.66	11.05	10.56	11.12	21.70
March	1,897	2,548	221	170.1	233	183,466	8.60	.67	------	------	10.50	11.06	21.25
April	1,644	2,312	220	169.4	233	170,263	8.50	.67	11.28	10.55	10.16	10.81	20.30
May	1,859	2,569	223	171.6	236	174,536	8.30	.70	------	------	9.85	11.06	19.75
June	2,184	2,926	226	173.5	237	187,160	8.15	.71	------	------	9.91	11.44	20.58
July	1,722	2,260	238	181.9	244	184,683	8.60	.72	------	------	9.94	11.94	22.58
August	1,491	1,799	233	177.4	248	164,451	8.75	.80	10.92	9.98	9.42	12.12	21.48
September	1,436	1,907	225	170.6	242	132,069	8.60	.78	------	------	9.65	11.88	19.88
October	1,943	2,682	216	162.6	229	82,581	7.55	.74	------	------	10.08	10.69	17.50
November	1,995	3,047	207	157.4	218	74,570	7.50	.70	------	------	10.82	10.12	17.12
December	2,838	4,271	214	163.9	226	141,602	7.10	.65	10.25	10.25	10.00	9.81	16.88
1915													
January	2,915	4,274	216	167.0	223	205,732	6.80	.73	------	------	10.72	9.74	18.55
February	2,651	3,885	215	166.3	224	243,795	6.70	.73	10.41	11.02	10.46	9.50	18.18
March	2,439	3,446	219	168.6	231	264,096	6.65	.73	------	------	9.96	9.24	17.25
April	1,816	2,563	223	171.7	231	267,009	7.05	.76	10.68	10.69	9.91	9.62	17.12
May	1,961	2,869	225	173.2	233	279,229	7.40	.77	------	------	9.86	10.12	17.72
June	2,234	3,246	225	172.7	231	300,956	7.35	.74	------	------	9.42	10.00	17.30
July	1,837	2,493	231	176.6	238	294,233	6.95	.79	------	------	8.46	9.62	14.96
August	1,605	2,041	237	180.4	246	268,290	6.70	.79	8.85	8.54	7.87	8.62	13.65
September	1,363	1,890	229	173.7	235	216,031	7.20	.72	------	------	8.10	8.38	12.75
October	1,624	2,494	203	152.9	204	136,271	7.75	.63	------	------	8.92	9.75	14.18
November	2,600	3,739	192	146.0	187	106,544	6.85	.65	------	------	8.98	10.00	17.38
December	3,567	5,442	197	150.8	190	150,381	6.60	.72	10.86	9.94	9.52	9.88	16.88
1916													
January	3,847	4,629	197	152.3	195	207,927	7.30	.76	------	------	10.40	10.31	19.53
February	3,104	3,484	210	162.4	204	239,350	8.30	.76	11.38	10.46	9.95	10.69	20.50
March	2,252	2,985	207	159.4	214	237,628	9.60	.74	------	------	10.86	11.56	22.00
April	2,412	2,645	211	162.4	219	227,900	9.70	.77	12.70	14.79	12.04	12.25	23.56
May	2,395	3,084	211	162.4	220	216,365	9.85	.74	------	------	12.56	12.56	23.50
June	2,297	2,685	218	167.3	226	206,133	9.75	.74	------	------	12.71	12.94	23.25
July	1,884	2,411	225	172.0	231	211,800	9.75	.81	------	------	12.94	13.56	26.43
August	2,157	1,705	223	169.8	232	180,672	10.20	.85	12.70	13.25	13.40	13.94	27.06
September	1,609	1,322	213	161.5	223	145,746	10.55	.87	------	------	14.46	14.50	28.50
October	2,462	2,195	203	152.9	210	125,387	9.85	1.00	------	------	15.74	14.19	28.75
November	3,575	3,043	196	149.0	195	128,907	9.85	1.00	------	------	16.98	14.31	28.62
December	3,712	3,723	193	147.8	193	173,320	10.05	.92	14.32	15.94	16.00	13.50	29.25
1917													
January	3,587	4,629	198	153.1	199	192,977	11.00	.98	------	------	15.79	14.44	29.88
February	2,656	3,484	203	156.9	204	199,539	12.50	1.00	16.05	17.16	17.09	15.94	30.18
March	2,189	2,985	205	157.8	209	181,890	14.90	1.13	------	------	19.38	17.50	33.62
April	1,982	2,645	206	158.6	213	167,386	15.80	1.42	19.96	21.22	21.12	19.38	37.00
May	2,265	3,084	209	160.9	217	170,216	16.00	1.63	------	------	21.91	20.50	38.28
June	2,069	2,685	217	166.6	225	200,633	15.65	1.67	------	------	21.19	21.15	38.92
July	1,991	2,411	223	170.5	232	216,045	15.20	2.05	------	------	20.68	21.55	40.58
August	1,331	1,705	220	167.5	233	182,874	17.00	2.03	20.89	21.19	22.26	22.86	42.00
September	1,035	1,322	221	167.6	231	147,787	18.30	2.10	------	------	24.22	25.19	44.38
October	1,721	2,195	206	155.1	212	87,416	17.25	2.02	------	------	23.88	27.00	44.00
November	2,547	3,043	205	155.9	209	92,918	17.60	2.07	------	------	26.64	26.88	47.25
December	2,711	3,723	208	159.3	211	144,724	16.95	1.75	24.49	24.20	24.70	25.50	48.50
1918													
January	3,025	3,961	215	166.3	216	163,719	16.40	1.78	------	------	24.45	23.81	47.75
February	3,173	3,998	225	174.0	231	203,241	16.70	1.75	25.92	26.32	26.01	24.69	49.00
March	3,115	3,926	229	176.3	238	224,825	17.00	1.70	------	------	25.90	24.44	49.25
April	2,715	3,290	229	176.3	242	228,853	17.40	1.68	------	------	25.22	23.21	47.30
May	2,433	3,092	227	174.7	238	245,237	17.45	1.60	------	------	24.65	22.25	42.88
June	2,159	2,783	226	173.5	235	203,311	16.50	1.58	------	------	24.61	22.42	42.08
July	2,272	2,940	232	177.3	243	207,002	17.70	1.68	------	------	26.16	23.95	44.80
August	1,718	2,283	228	173.6	243	187,585	18.90	1.70	------	------	26.65	24.45	44.15
September	1,566	1,980	226	171.4	247	152,901	19.55	1.53	------	------	26.89	23.65	41.30
October	2,333	3,018	218	164.2	233	136,263	17.55	1.40	------	------	26.06	21.98	36.25
November	3,240	4,280	213	162.0	226	150,875	17.70	1.38	------	------	26.78	24.75	41.50
December	4,082	5,662	213	163.1	223	174,707	17.55	1.45	24.36	24.85	25.06	25.50	47.88

TABLE 1.—*Data used in the statistical analysis*—Continued

Year and month	Monthly supply of hogs						Prices at Chicago						
	Receipts of hogs at 11 markets	Monthly slaughter under Federal inspection			Average live weight of hogs at Chicago	Stocks of provisions at Chicago	Average price of heavy hogs, per 100 lbs.	Average price of corn, per bu.	Quotations for delivery in five months		Lard, per 100 lbs.	Short ribs, per 100 lbs.	Mess pork, per bbl.
		Number	Live wt.	Dressed weight (pork and lard)					Short ribs, per 100 lbs.	Lard, per 100 lbs.			
1919	*Thousands*	*Thousands*	*Lbs.*	*Lbs.*	*Lbs.*	*1,000 pounds*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*
January	4,110	5,845	218	168.6	228	209,649	17.60	1.42	------	------	23.12	23.38	44.75
February	3,160	4,266	220	170.1	232	191,646	17.65	1.30	21.89	23.28	24.15	23.25	42.88
March	2,560	3,443	218	167.8	230	180,290	19.00	1.48	------	------	27.05	25.62	45.38
April	2,504	3,208	218	167.8	230	184,558	20.30	1.64	26.82	30.80	30.78	27.69	50.25
May	2,739	3,743	220	169.3	232	174,536	20.65	1.73	------	------	33.68	29.10	54.06
June	2,840	3,728	225	172.7	233	186,212	20.30	1.78	------	------	34.68	28.50	53.75
July	2,251	2,884	232	177.3	242	197,076	21.65	1.95	------	------	34.48	28.19	53.38
August	1,493	1,949	236	179.7	251	170,574	19.75	1.97	19.62	26.55	30.42	24.75	47.75
September	1,555	1,997	232	176.0	254	162,247	17.25	1.58	------	------	26.02	20.75	40.25
October	1,992	2,686	221	166.4	237	153,070	14.25	1.45	------	------	28.16	18.62	39.00
November	2,559	3,270	217	165.0	226	130,708	14.10	1.52	------	------	25.44	19.50	42.50
December	3,577	4,790	214	163.9	224	147,860	13.50	1.51	18.51	23.70	23.06	18.62	41.50
1920													
January	3,670	5,079	220	170.1	229	187,661	14.90	1.50	------	------	23.48	19.12	40.75
February	2,331	3,104	218	168.6	231	200,475	14.30	1.44	19.64	22.39	20.80	18.38	38.50
March	2,689	3,482	224	172.4	237	220,819	14.65	1.60	------	------	20.48	18.38	38.00
April	1,967	2,590	229	176.3	243	226,257	14.40	1.73	19.40	21.26	19.40	18.50	37.00
May	2,885	3,585	226	174.0	239	247,306	14.00	2.03	------	------	20.42	18.50	35.50
June	2,562	3,566	227	174.0	236	276,744	14.35	1.89	------	------	20.38	17.81	33.88
July	2,027	2,644	239	177.6	242	263,217	14.50	1.62	------	------	19.00	16.62	29.06
August	1,742	2,191	235	176.8	250	243,023	14.45	1.54	------	19.10	18.40	15.25	25.46
September	1,493	1,979	228	169.8	248	188,363	15.55	1.37	------	------	19.60	16.56	24.95
October	1,720	2,487	222	163.4	236	87,302	13.70	.96	------	------	19.62	16.50	24.25
November	2,570	3,329	218	163.5	224	80,089	12.00	.81	------	------	19.22	14.62	24.38
December	2,896	3,985	221	166.5	228	114,211	9.40	.78	12.39	14.00	19.81	12.62	24.25
1921													
January	3,355	4,347	227	172.7	229	143,122	9.25	.71	------	------	12.96	11.75	24.75
February	2,850	3,799	228	176.2	230	183,901	9.10	.66	11.64	12.51	11.95	11.38	24.25
March	2,266	3,047	228	174.4	238	187,696	9.60	.64	------	------	11.52	11.38	23.00
April	2,197	3,003	226	173.6	237	205,034	8.25	.58	9.68	9.79	10.05	9.62	19.75
May	2,320	3,274	220	171.3	238	230,344	8.20	.63	------	------	9.45	9.75	18.62
June	2,565	3,618	224	171.2	238	248,386	8.10	.62	------	------	9.86	9.94	18.88
July	1,960	2,821	246	187.7	240	232,298	9.50	.61	------	------	11.35	10.62	19.38
August	1,879	2,530	234	178.5	251	189,512	9.15	.57	8.72	------	11.18	10.00	20.00
September	1,746	2,422	228	174.2	250	125,640	7.40	.53	------	------	10.80	8.62	21.00
October	2,100	2,866	223	167.7	235	85,388	7.40	.46	------	------	9.42	6.75	20.25
November	2,554	3,447	216	164.7	223	74,394	6.80	.49	------	------	9.10	6.62	19.25
December	2,647	3,807	221	168.7	225	75,494	6.75	.49	7.99	9.03	8.65	7.75	18.25
1922													
January	2,886	3,985	224	173.9	229	94,057	7.80	.49	------	------	9.31	8.62	17.88
February	2,373	3,480	222	170.7	232	100,242	9.60	.57	10.64	11.46	11.04	10.75	20.00
March	2,211	3,350	222	170.1	240	125,958	10.20	.59	------	------	11.20	11.38	21.12
April	1,921	2,946	225	172.8	242	136,696	10.15	.59	10.90	11.22	10.62	12.25	21.12
May	2,555	3,716	226	173.4	241	165,409	10.25	.62	------	------	11.18	12.75	24.50
June	2,741	4,046	231	178.1	241	191,915	10.10	.62	------	------	11.36	12.62	26.75
July	2,150	3,104	239	183.3	246	191,401	9.40	.64	------	------	11.08	11.50	27.00
August	2,107	2,888	242	182.1	255	175,243	8.15	.63	------	9.18	10.80	10.50	25.75
September	1,973	2,747	234	177.7	250	124,302	8.50	.64	------	------	10.74	10.75	24.25
October	2,383	3,332	219	165.7	241	81,872	8.60	.69	------	------	10.98	11.12	25.50
November	2,905	4,318	215	162.5	232	76,651	7.90	.72	------	------	11.39	11.25	26.00
December	3,448	5,201	220	169.5	233	95,797	8.00	.74	9.75	10.66	11.05	11.00	24.75
1923													
January	3,692	5,134	227	176.8	235	114,638	8.21	.72	------	------	11.25	11.06	24.00
February	3,119	4,231	228	177.9	234	130,342	7.96	.74	10.90	11.56	11.25	10.75	24.50
March	3,414	4,838	228	177.0	237	143,232	8.15	.75	------	------	11.74	10.44	24.75
April	3,930	4,179	229	176.5	239	187,567	8.03	.81	10.50	11.84	11.35	10.94	23.25
May	3,141	4,325	224	170.9	237	186,564	7.46	.82	------	------	10.89	9.12	23.00
June	3,057	4,303	228	174.7	240	210,195	6.94	.84	------	------	11.01	9.25	22.50
July	3,074	3,983	232	177.1	239	218,202	7.18	.88	------	------	10.71	8.75	22.25
August	2,632	3,556	236	181.3	242	198,303	7.91	.89	8.96	10.65	11.19	8.62	22.00
September	2,413	3,212	229	172.8	244	150,302	8.50	.89	------	------	12.09	9.25	22.00
October	3,255	4,328	219	165.2	239	108,591	7.64	1.05	------	------	12.65	9.88	22.00
November	3,678	5,341	216	164.2	235	103,309	7.04	.94	------	------	13.30	10.00	22.25
December	4,078	5,904	218	166.0	235	131,019	7.03	.73	9.86	12.14	12.56	9.69	22.50

TABLE 1.—*Data used in the statistical analysis*—Continued

Year and month	Monthly supply of hogs						Prices at Chicago						
	Receipts of hogs at 11 markets	Monthly slaughter under Federal inspection			Average live weight of hogs at Chicago	Stocks of provisions at Chicago	Average price of heavy hogs, per 100 lbs.	Average price of corn, per bu.	Quotations for delivery in five months		Lard, per 100 lbs.	Short ribs, per 100 lbs.	Mess pork, per bbl.
		Number	Live wt.	Dressed weight (pork and lard)					Short ribs, per 100 lbs.	Lard, per 100 lbs.			
1924	*Thousands*	*Thousands*	*Lbs.*	*Lbs.*	*Lbs.*	*1,000 pounds*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*	*Dols.*
January	4, 534	5, 911	217	165. 9	230	145, 961	7. 23	. 77	------	------	11. 88	9. 75	22. 50
February	3, 913	5, 006	221	169. 2	229	177, 978	7. 18	. 82	10. 09	11. 42	11. 04	9. 56	22. 25
March	3, 515	4, 536	223	169. 5	234	194, 525	7. 41	. 80	------	------	10. 94	9. 50	22. 00
April	3, 100	4, 073	224	170. 2	234	201, 170	7. 42	. 79	10. 60	11. 25	10. 71	9. 88	22. 50
May	3, 132	4, 278	224	169. 3	236	217, 275	7. 46	. 79	------	------	10. 40	10. 06	23. 00
June	3, 205	4, 288	229	172. 6	237	237, 935	7. 26	. 83	------	------	10. 55	10. 06	23. 00
July	3, 093	4, 114	237	178. 7	239	240, 667	8. 26	1. 10	------	------	12. 22	11. 12	24. 25
August	2, 350	3, 070	239	179. 6	242	208, 980	9. 82	1. 18	------	------	13. 60	12. 25	26. 00
September	2, 217	2, 857	232	173. 2	244	164, 779	9. 84	1. 17	------	------	13. 62	12. 31	27. 25
October	2, 811	3, 498	220	160. 7	236	87, 572	10. 62	1. 11	------	------	15. 62	12. 88	29. 00
November	3, 571	4, 641	212	156. 4	229	75, 887	9. 56	1. 13	------	------	14. 84	13. 25	30. 00
December	5, 049	6, 600	209	156. 1	227	134, 037	10. 11	1. 23	15. 30	16. 50	16. 01	14. 69	30. 50
1925													
January	4, 571	5, 979	212	159. 6	226	183, 684	10. 71	1. 30	------	------	15. 98	15. 08	32. 50
February	3, 379	4, 447	216	163. 3	222	227, 153	11. 26	1. 29	16. 72	16. 22	16. 08	15. 80	34. 50
March	2, 534	3, 299	219	166. 7	228	218, 489	13. 74	1. 20	------	------	16. 42	18. 11	37. 00
April	2, 307	3, 037	225	171. 7	233	214, 410	12. 58	1. 09	16. 48	15. 99	15. 35	16. 15	37. 50
May	2, 376	3, 186	229	175. 2	235	197, 989	12. 15	1. 18	------	------	15. 36	16. 68	36. 00
June	2, 600	3, 732	231	175. 0	237	201, 696	12. 60	1. 14	------	------	16. 85	18. 32	37. 00
July	2, 086	2, 819	241	182. 4	243	195, 153	13. 60	1. 09	------	------	17. 37	18. 62	38. 00
August	1, 863	2, 453	246	187. 3	249	167, 059	12. 99	1. 03	------	15. 50	17. 24	18. 56	38. 00
September	1, 965	2, 598	239	178. 3	250	125, 532	12. 82	. 90	------	------	17. 05	18. 00	38. 00
October	2, 402	3, 314	229	170. 7	246	32, 276	11. 58	. 83	------	------	15. 62	16. 62	36. 50
November	2, 705	3, 646	222	166. 9	241	84, 291	11. 37	. 85	------	------	15. 68	16. 62	34. 50
December	3, 143	4, 533	225	171. 3	238	96, 414	10. 86	. 82	14. 68	14. 16	14. 82	15. 12	33. 00

TABLE 2.—*Data used in the statistical analysis*

Year and month	Exports					Miscellaneous data				Derived figures used in the study		
	Pork products [1]				Index of physical volume of exports [2]	Prices of industrial stocks [3]		Bureau of Labor all-commodity index of wholesale prices [5] (1913 base)	United States population monthly [6]	Corn-hog differential	Index of export demand [2]	Index of total demand [2]
	Pork	Bacon	Hams and shoulders	Lard		Actual	Deviation from trend [4]					
	10,000 pounds	*10,000 pounds*	*10,000 pounds*	*10,000 pounds*	*Million pounds*	*Dols.*	*Per cent*		*Millions*	*Dols.*		
1896												
January	781	4,703	1,371	5,645	140	------	------	------	------	+0.87	------	------
February	588	3,122	861	2,946	85	------	------	------	------	+.90	------	------
March	371	2,708	929	3,478	84	------	------	------	------	+.59	------	------
April	427	3,052	1,097	3,997	97	------	------	------	------	+.12	------	------
May	385	2,831	1,298	4,527	102	------	------	------	------	−.01	------	------
June	503	3,821	1,869	4,390	122	------	------	------	------	+.07	------	------
July	592	4,014	1,797	3,342	113	------	------	------	------	+.08	------	------
August	481	3,630	1,498	4,072	111	------	------	------	------	+.42	------	------
September	571	3,189	948	5,158	109	------	------	------	------	+.50	------	------
October	622	4,009	1,202	5,585	128	------	------	------	------	+.51	------	------
November	460	4,247	1,346	4,626	121	------	------	------	------	+.51	------	------
December	604	4,359	1,475	4,864	128	------	------	------	------	+.62	------	------
1897												
January	688	4,399	1,196	3,724	114	41.9	------	------	------	+.72	------	------
February	625	4,563	1,098	5,116	128	41.1	------	------	------	+.72	------	------
March	653	4,589	983	5,463	130	40.7	------	------	------	+1.11	------	------
April	625	4,378	1,383	4,848	127	39.5	------	------	------	+1.31	------	------
May	472	3,855	1,813	4,653	124	39.4	------	------	------	+1.01	------	------
June	414	4,808	1,786	5,377	141	42.3	------	------	------	+.66	------	------
July	590	5,338	1,561	5,590	148	45.8	------	------	------	+.53	------	------
August	528	5,255	1,703	4,635	139	51.8	------	------	------	+.47	------	------
September	701	5,006	1,729	5,469	139	53.4	------	------	------	+.57	------	------
October	577	4,522	1,262	5,465	131	50.6	------	------	------	+.67	------	------
November	597	5,141	1,134	4,962	139	47.4	------	------	------	+.32	------	------
December	826	5,954	1,547	7,522	177	49.0	------	------	------	+.38	------	------
1898												
January	1,097	6,272	1,398	6,445	170	49.4	------	------	------	+.57	------	------
February	905	5,330	1,814	5,134	150	47.5	------	------	------	+.69	------	------
March	1,191	6,182	2,189	7,561	193	44.8	------	------	------	+.59	------	------
April	1,027	5,922	2,096	6,021	172	44.8	------	------	------	+.25	------	------
May	1,160	5,588	2,144	7,416	184	50.5	------	------	------	+.35	------	------
June	836	4,501	1,440	4,715	130	52.3	------	------	------	+.45	------	------
July	824	3,826	1,543	2,814	104	53.3	------	------	------	+.07	------	------
August	1,047	5,384	2,041	4,840	153	57.8	------	------	------	+.25	------	------
September	1,247	4,902	1,896	6,784	167	57.0	------	------	------	+.42	------	------
October	1,522	4,546	1,916	7,337	171	53.5	------	------	------	+.16	------	------
November	1,771	4,314	1,579	6,857	161	55.8	------	------	------	−.32	------	------
December	2,104	5,197	1,945	7,731	189	59.3	------	------	------	−.71	------	------
1899												
January	1,978	5,863	1,928	6,222	180	62.7	------	------	------	−.48	------	------
February	1,592	3,981	1,956	5,332	146	64.8	------	------	------	−.20	------	------
March	1,813	4,809	2,129	6,495	172	70.3	------	------	------	−.20	------	------
April	1,598	4,317	1,844	5,244	147	75.0	------	------	------	−.15	------	------
May	1,266	4,092	1,620	5,617	142	71.8	------	------	------	+.13	------	------
June	1,096	5,029	2,189	5,844	162	70.8	------	------	------	−.08	------	------
July	1,246	5,014	2,066	5,896	162	72.2	------	------	------	+.48	------	------
August	1,103	5,497	2,230	4,713	156	75.0	------	------	------	+.90	------	------
September	1,148	4,347	1,274	4,734	129	75.0	------	------	------	+.63	------	------
October	1,395	4,496	1,332	6,667	154	73.0	------	------	------	+.65	------	------
November	1,416	3,808	1,353	5,736	137	74.5	------	------	------	+.25	------	------
December	1,866	4,547	1,746	6,508	164	67.0	------	------	------	+.51	------	------

[1] Monthly Summary of Commerce and Finance of the United States, 1896–June, 1914 (*27*). Monthly Summary of Foreign Commerce of the United States, July, 1914–1925 (*24*). Cumberland sides included with bacon and Wiltshire sides included with hams and shoulders.

[2] Variable bases; see pages 39, 40, and 41 for method of computation.

[3] The Review of Economic Statistics, Harvard Economic Service (*18, p. 166–167, 191–197; 10, p. 118, 390; 11, p. 346, 1920; 11, p. 376, 1921; 3, p. 402; 4, p. 139; 9, p. 286*). Harvard Weekly Letters, Jan. 20, 1923; Dec. 22, 1923; Dec. 13, 1924; July 11, 1925; Sept. 12, 1925 (*12, 13, 14*).

[4] Corrected for seasonal variation.

[5] Bureau of Labor Statistics Bulletins 367 and 390, special reports (*25, 26*).

[6] Computed from estimates of annual population by the Bureau of the Census. Increase in population from one census year to another arbitrarily distributed to show an even monthly increase.

TABLE 2.—*Data used in the statistical analysis*—Continued

Year and month	Exports					Miscellaneous data				Derived figures used in the study		
	Pork products				Index of physical volume of exports	Prices of industrial stocks		Bureau of Labor all-commodity index of wholesale prices (1913 base)	United States population monthly	Corn-hog differential	Index of export demand	Index of total demand
	Pork	Bacon	Hams and shoulders	Lard		Actual	Deviation from trend					
1900	*10,000 pounds*	*10,000 pounds*	*10,000 pounds*	*10,000 pounds*	*Million pounds*	*Dols.*	*Per cent*		*Millions*	*Dols.*		
January	1,422	3,569	1,367	5,268	130	65.7	-------	82	-------	+1.01	-------	-------
February	1,756	4,076	1,419	5,483	142	65.9	-------	82	-------	+1.13	-------	-------
March	1,974	4,191	1,341	5,630	146	63.6	-------	82	-------	+.89	-------	-------
April	1,125	3,732	1,608	5,730	137	63.4	-------	82	-------	+.98	-------	-------
May	1,205	3,537	1,865	5,037	132	59.0	-------	81	-------	+.96	-------	-------
June	1,109	4,400	2,041	4,780	141	56.6	-------	80	-------	+.63	-------	-------
July	1,265	4,068	2,149	4,134	134	57.3	-------	80	75.99	+.45	-------	-------
August	1,356	4,003	2,292	4,975	145	58.0	-------	80	76.14	+.75	-------	-------
September	1,478	3,878	1,234	5,470	134	55.8	-------	80	76.29	+.57	-------	-------
October	1,362	3,086	1,410	5,136	124	57.7	-------	79	76.44	+.35	-------	-------
November	1,577	3,687	1,233	4,584	124	64.2	-------	80	76.58	.00	-------	-------
December	1,957	4,764	1,783	4,719	149	67.5	-------	79	76.73	+.41	-------	-------
1901												
January	1,730	4,484	1,647	5,943	152	67.6	-------	79	76.87	+1.02	-------	-------
February	1,590	3,931	1,467	5,200	134	68.9	-------	78	77.02	+.95	-------	-------
March	1,909	4,110	2,012	6,179	156	68.6	-------	78	77.17	+1.10	-------	-------
April	1,395	3,200	1,886	4,297	119	73.4	-------	78	77.31	+.71	-------	-------
May	1,223	3,170	2,327	5,495	135	71.7	-------	78	77.46	−.02	-------	-------
June	989	3,230	2,128	5,003	126	77.2	-------	78	77.60	+1.09	-------	-------
July	1,086	3,843	2,398	4,519	132	73.3	-------	78	77.75	+.08	-------	-------
August	1,299	4,305	1,912	4,955	139	71.5	-------	79	77.88	−.56	-------	-------
September	1,342	4,045	2,027	4,370	131	69.8	-------	81	78.02	+.14	-------	-------
October	1,312	3,408	1,592	4,371	118	64.8	-------	80	78.15	−.30	-------	-------
November	1,571	3,241	1,880	4,898	128	65.5	-------	81	78.30	−1.27	-------	-------
December	2,298	3,793	1,769	5,497	146	63.2	-------	83	78.43	−1.22	-------	-------
1902												
January	1,978	3,888	1,642	4,147	132	63.9	-------	82	78.57	−0.57	-------	-------
February	1,485	2,283	1,338	4,641	106	65.1	-------	81	78.70	−.44	-------	-------
March	1,310	2,809	1,909	5,811	130	66.2	-------	81	78.84	−.24	-------	-------
April	1,480	2,815	1,969	4,804	122	67.2	-------	82	78.97	+.13	-------	-------
May	1,040	1,946	2,313	3,808	101	65.9	-------	84	79.11	−.08	-------	-------
June	766	1,939	2,015	3,864	95	65.0	-------	84	79.24	−.04	-------	-------
July	1,046	1,926	2,188	3,364	95	65.8	-------	85	79.37	−.42	-------	-------
August	1,019	1,933	1,645	3,044	85	66.1	-------	83	79.50	+.74	-------	-------
September	834	1,670	1,740	3,263	83	66.0	-------	84	79.63	+.70	-------	-------
October	843	1,564	1,818	3,447	85	65.2	-------	91	79.77	+.38	-------	-------
November	861	1,716	1,796	3,884	91	63.2	-------	87	79.90	+.07	-------	-------
December	1,584	2,526	2,125	6,340	137	62.0	-------	88	80.04	+.53	-------	-------
1903												
January	1,516	2,269	1,833	6,434	131	65.3	−0.2	90	80.17	+1.35	-------	-------
February	1,310	1,926	1,312	4,488	98	66.6	−.1	89	80.31	+1.98	-------	-------
March	1,376	1,524	1,821	4,167	97	64.5	−.3	87	80.44	+2.43	-------	-------
April	987	1,192	1,279	3,414	75	62.7	−.5	86	80.58	+2.28	-------	-------
May	792	1,133	1,354	3,400	73	62.2	−.5	85	80.71	+1.46	-------	-------
June	816	1,355	2,507	3,831	94	58.3	−.9	85	80.84	+.34	-------	-------
July	1,152	1,580	1,988	3,349	89	54.0	−1.4	84	80.97	−.37	-------	-------
August	1,269	1,937	2,206	3,209	96	50.7	−1.7	84	81.11	−.64	-------	-------
September	1,061	2,626	1,494	4,337	105	49.0	−1.9	85	81.24	+.15	-------	-------
October	1,081	1,686	1,444	5,188	102	44.9	−2.3	84	81.38	+.26	-------	-------
November	845	1,964	1,575	5,235	105	43.9	−2.4	84	81.51	−.31	-------	-------
December	1,677	2,160	1,736	6,487	130	46.9	−2.1	84	81.65	−.30	-------	-------
1904												
January	1,639	2,864	1,677	5,959	132	48.8	−2.0	86	81.78	−.19	96	89
February	1,371	2,388	1,431	4,566	107	47.9	−2.1	87	81.92	−.46	95	88
March	1,341	2,404	1,482	4,412	106	47.8	−2.1	87	82.05	−.55	93	88
April	707	1,916	1,090	4,305	88	49.3	−2.0	85	82.19	−.67	93	84
May	843	1,605	1,452	4,010	87	48.1	−2.1	84	82.32	−.85	92	82
June	1,047	1,834	1,920	5,073	108	48.8	−2.1	84	82.46	−.55	92	92
July	776	1,661	1,681	3,419	83	51.2	−1.8	84	82.59	−.25	91	96
August	1,020	1,853	1,821	3,710	93	53.7	−1.6	85	82.73	−.92	93	94
September	930	2,278	1,337	5,374	108	56.3	−1.3	86	82.86	−.35	95	100
October	1,051	1,973	1,517	5,751	112	61.1	−.9	86	83.00	−.82	95	97
November	1,032	1,969	1,681	4,195	97	68.1	−.3	87	83.13	−1.37	101	95
December	1,438	2,502	1,740	5,577	123	69.5	−.1	88	83.27	−.75	102	88

TABLE 2.—*Data used in the statistical analysis*—Continued

Year and month	Exports					Miscellaneous data				Derived figures used in the study		
	Pork products				Index of physical volume of exports	Prices of industrial stocks		Bureau of Labor all-commodity index of wholesale prices (1913 base)	United States population monthly	Corn-hog differential	Index of export demand	Index of total demand
	Pork	Bacon	Hams and shoulders	Lard		Actual	Deviation from trend					
	10,000 pounds	*10,000 pounds*	*10,000 pounds*	*10,000 pounds*	*Million pounds*	*Dols.*	*Per cent*		*Millions*	*Dols.*		
1905												
January	1,489	2,668	1,518	5,300	120	70.1	−.1	87	83.40	−.21	105	91
February	1,244	2,213	1,588	5,457	118	73.6	+.2	87	83.54	−.12	106	93
March	1,502	2,397	1,640	6,619	132	78.0	+.6	86	83.67	−.17	103	94
April	1,417	2,230	1,687	5,865	122	80.0	+.7	87	83.81	−.03	104	97
May	1,301	2,084	1,959	4,570	109	74.7	+.2	85	83.94	−1.00	108	105
June	1,208	2,398	1,877	5,187	117	75.2	+.3	85	84.08	−.87	111	101
July	1,262	2,514	2,439	5,013	124	79.6	+.7	85	84.21	−.80	115	103
August	1,292	2,382	2,108	5,450	123	81.7	+.8	86	84.35	−.38	122	108
September	1,010	1,967	1,110	5,871	108	80.3	+.7	85	84.48	−.65	116	97
October	1,057	2,139	1,524	5,885	115	82.3	+.8	86	84.62	−.84	118	94
November	1,358	2,793	1,264	6,776	132	85.4	+1.1	86	84.75	−.80	121	95
December	2,031	4,002	1,709	8,175	173	93.1	+1.8	87	84.89	−.35	122	96
1906												
January	1,838	4,094	1,734	8,531	176	98.7	+2.3	88	85.02	+.60	123	101
February	2,029	3,811	1,491	6,363	149	97.8	+2.2	87	85.16	+1.32	124	110
March	1,418	3,204	344	5,975	118	95.0	+1.9	87	85.29	+1.50	126	110
April	1,274	3,254	1,507	5,987	132	93.5	+1.7	88	85.43	+1.25	128	110
May	1,164	2,865	1,590	5,162	118	90.1	+1.4	88	85.56	+.85	125	110
June	1,063	3,094	1,605	4,965	118	91.1	+1.5	88	85.70	+.61	121	112
July	1,215	2,766	2,057	5,394	126	88.8	+1.3	86	85.83	+1.00	123	113
August	1,118	3,244	2,139	5,876	136	93.9	+1.7	88	85.96	+.33	112	103
September	1,098	3,108	1,522	6,328	132	94.7	+1.7	88	86.09	+.44	110	101
October	1,434	2,539	1,695	4,704	114	94.8	+1.7	90	86.22	+.80	109	107
November	1,587	1,284	1,282	3,738	85	93.9	+1.7	91	86.35	+.95	111	111
December	1,822	1,513	1,577	4,801	105	94.4	+1.7	92	86.48	+1.00	111	113
1907												
January	2,209	2,163	1,832	6,717	139	93.6	+1.6	92	86.61	+1.80	113	116
February	1,812	1,880	1,654	6,145	124	91.6	+1.4	93	86.74	+2.03	116	117
March	1,491	1,901	1,619	5,115	110	82.8	+.6	92	86.87	+1.63	103	108
April	1,303	1,575	1,672	4,719	101	83.1	+.6	93	87.00	+1.12	99	104
May	1,371	1,447	1,868	4,803	103	81.2	+.4	94	87.13	+.30	100	99
June	1,602	1,630	2,032	4,415	106	78.9	+.2	95	87.32	.00	96	96
July	1,327	2,079	1,955	5,919	123	80.7	+.3	95	87.45	−.27	95	98
August	1,386	2,214	2,146	5,627	124	74.1	−.3	95	87.58	−.72	100	100
September	1,356	1,563	1,255	4,109	90	70.6	−.5	95	87.71	−1.28	101	95
October	1,502	1,547	1,608	3,687	91	62.6	−1.3	96	87.84	−.92	103	105
November	1,357	1,342	1,588	4,507	95	55.8	−1.9	93	87.97	−1.72	104	91
December	1,351	1,462	1,478	3,163	82	59.3	−1.6	91	88.10	−2.20	104	89
1908												
January	2,072	1,994	1,730	6,658	134	62.7	−1.3	89	88.23	−2.29	100	83
February	2,092	2,474	2,339	8,721	169	60.4	−1.5	88	88.36	−2.12	95	79
March	1,798	2,579	2,280	6,812	147	65.5	−1.1	89	88.49	−2.03	93	85
April	1,207	3,019	2,107	4,134	116	68.7	−.8	89	88.62	−1.80	95	100
May	882	1,845	1,771	3,411	88	72.5	−.5	89	88.75	−3.07	94	100
June	753	1,996	1,921	3,594	92	73.1	−.5	90	88.94	−2.31	97	110
July	612	2,312	1,870	3,310	91	76.6	−.2	90	89.07	−1.90	99	117
August	497	2,197	1,762	2,871	82	83.0	+.3	90	89.20	−2.42	97	114
September	500	1,673	1,432	4,622	90	80.9	+.1	91	89.33	−2.24	98	115
October	510	1,844	1,527	3,927	86	81.6	+.2	91	89.46	−2.29	88	105
November	630	2,005	1,528	3,634	86	85.7	+.5	92	89.59	−1.41	91	107
December	814	2,540	1,816	6,500	127	85.6	+.5	93	89.72	−1.10	91	102
1909												
January	685	2,281	1,876	5,514	114	85.6	+.5	93	89.85	−.65	90	104
February	561	2,002	1,786	4,412	97	83.3	+.3	93	89.98	−.74	89	102
March	574	2,295	1,884	5,759	115	83.9	+.3	94	90.11	−.74	87	100
April	531	1,918	1,983	3,880	93	85.9	+.5	95	90.24	−.69	92	102
May	434	1,666	1,979	3,677	86	90.3	+.8	97	90.37	−1.05	90	101
June	421	1,723	1,773	4,766	95	92.1	+.9	97	90.56	−.65	94	105
July	410	1,811	1,451	2,864	73	94.8	+1.1	97	90.70	−.21	91	102
August	432	1,506	1,500	3,391	75	97.8	+1.4	98	90.84	−.17	83	96
September	375	1,553	1,470	2,620	67	98.0	+1.4	99	90.99	+.56	86	97
October	355	1,342	1,110	2,729	61	98.1	+1.4	101	91.13	+.88	75	93
November	356	1,659	1,505	2,753	70	98.2	+1.4	102	91.27	+.91	77	100
December	346	1,498	1,258	3,462	72	98.0	+1.3	103	91.41	+1.14	80	105

TABLE 2.—*Data used in the statistical analysis*—Continued

Year and month	Exports					Miscellaneous data				Derived figures used in the study		
	Pork products				Index of physical volume of exports	Prices of industrial stocks		Bureau of Labor all-commodity index of wholesale prices (1913 base)	United States population monthly	Corn-hog differential	Index of export demand	Index of total demand
	Pork	Bacon	Hams and shoulders	Lard		Actual	Deviation from trend					
	10,000 pounds	*10,000 pounds*	*10,000 pounds*	*10,000 pounds*	*Million pounds*	*Dols.*	*Per cent*		*Millions*	*Dols.*		
1910												
January	516	1,634	1,421	3,969	83	94.5	+1.0	102	91.55	+1.28	86	104
February	454	1,147	1,178	3,888	73	88.2	+.5	102	91.70	+1.78	100	106
March	438	1,076	1,289	3,257	66	92.1	+.8	105	91.84	+3.46	150	112
April	298	634	769	1,721	38	89.4	+.5	105	91.98	+3.26	114	105
May	264	553	764	2,642	46	87.2	+.4	103	92.12	+2.65	100	104
June	268	803	973	2,998	55	83.8	+.1	102	92.27	+2.61	99	104
July	402	1,089	1,195	3,332	64	77.6	−.4	102	92.39	+1.41	73	94
August	362	1,375	1,381	3,618	72	78.8	−.3	102	92.50	+1.06	70	91
September	447	1,264	1,103	2,855	61	79.1	−.3	100	92.61	+2.42	85	99
October	410	844	958	2,616	52	83.0	.0	97	92.74	+2.74	92	105
November	332	865	957	2,860	54	84.2	+.1	95	92.86	+2.04	88	108
December	420	1,443	1,131	4,156	75	81.0	−.2	96	92.98	+2.17	89	108
1911												
January	482	1,288	1,277	4,460	78	83.3	−.1	95	93.09	+2.48	100	109
February	383	1,075	1,382	5,095	83	85.2	+.1	92	93.21	+1.88	87	100
March	389	1,104	1,244	5,771	89	83.2	−.1	93	93.33	+1.33	78	88
April	464	1,609	1,314	5,361	90	82.5	−.1	91	93.45	+.44	79	83
May	453	1,701	1,713	6,210	102	84.5	.0	90	93.57	−.32	81	85
June	564	1,911	2,116	5,065	101	86.5	+.1	90	93.68	−.25	83	92
July	610	1,701	1,966	4,075	87	85.9	+.1	92	93.80	−.54	85	101
August	483	1,886	1,981	3,889	87	82.2	−.3	94	93.92	−.16	94	110
September	514	2,504	1,845	5,845	113	76.6	−.7	95	94.04	−.90	88	101
October	475	1,637	1,174	4,669	83	76.8	−.7	95	94.15	−1.72	88	101
November	453	1,586	1,342	4,330	82	79.8	−.5	95	94.27	−1.99	90	104
December	561	1,810	1,607	5,729	101	80.9	−.4	94	94.39	−1.74	89	103
1912												
January	642	1,815	1,770	5,134	96	81.3	−.4	95	94.51	−1.35	88	98
February	606	1,695	1,740	6,218	103	80.9	−.4	96	94.63	−1.17	84	92
March	560	1,747	1,537	6,630	102	85.3	−.1	97	94.74	−.89	84	97
April	565	1,793	1,820	4,411	91	89.8	+.3	100	94.86	−1.06	91	102
May	541	1,627	2,101	4,992	97	89.1	+.2	100	94.98	−1.32	88	101
June	467	1,056	1,522	3,535	69	89.7	+.2	99	95.10	−.95	84	101
July	440	1,652	1,656	3,482	78	89.9	+.2	99	95.22	−.62	84	98
August	571	1,869	1,510	3,760	81	91.0	+.3	100	95.33	−.86	95	101
September	531	1,536	982	4,747	80	92.3	+.4	101	95.45	−.15	98	99
October	443	1,368	943	3,745	68	92.3	+.3	101	95.57	+1.34	109	107
November	449	1,387	994	3,740	70	90.8	+.2	101	95.69	+1.58	89	100
December	403	1,657	1,032	4,870	81	88.0	.0	101	95.80	+1.63	86	100
1913												
January	658	1,982	1,495	5,046	94	85.1	−.2	100	95.92	+1.80	87	96
February	587	2,033	1,436	6,640	111	81.2	−.5	100	96.04	+2.34	98	101
March	527	2,088	1,598	5,464	100	80.0	−.7	100	96.16	+2.81	116	106
April	443	1,705	1,589	4,546	87	80.8	−.6	100	96.28	+2.40	121	106
May	486	1,442	1,374	5,097	89	79.2	−.7	99	96.40	+1.78	112	106
June	497	1,381	1,346	4,423	81	74.7	−1.1	99	96.51	+1.53	116	111
July	486	1,656	1,686	4,368	86	77.2	−.9	100	96.63	+1.64	130	113
August	453	1,955	1,546	4,318	89	80.0	−.7	100	96.75	−.24	100	102
September	510	1,636	1,266	3,951	79	81.9	−.5	102	96.87	−.47	92	99
October	485	1,797	1,308	4,141	83	79.3	−.8	101	96.98	+.16	93	103
November	498	1,669	1,256	4,549	84	77.2	−.9	100	97.10	−.54	90	105
December	450	1,937	1,267	5,006	93	77.1	−.9	99	97.22	−.29	90	106
1914												
January	465	2,081	1,686	5,936	108	80.7	−.7	98	97.34	+1.16	108	110
February	371	1,752	1,514	3,758	80	82.3	−.6	99	97.46	+1.47	104	106
March	362	1,362	1,224	4,057	74	82.3	−.6	98	97.57	+.95	104	101
April	348	1,260	1,257	3,213	65	79.8	−.8	98	97.69	+.85	99	98
May	368	1,162	1,304	3,773	70	80.5	−.8	97	97.81	+.31	97	99
June	332	1,131	1,275	4,006	71	80.6	−.7	97	97.93	+.04	89	98
July	404	1,090	1,214	2,600	58	76.6	−1.1	97	98.04	+.38	103	104
August	389	1,441	912	2,680	58	(7)	(7)	101	98.16	−.39	106	104
September	303	1,760	871	3,005	64	(7)	(7)	102	98.28	−.31	104	101
October	219	1,384	855	4,883	79	(7)	(7)	97	98.40	−.90	96	98
November	196	1,883	994	4,303	80	(7)	(7)	97	98.52	−.49	102	104
December	347	2,122	1,134	3,766	80	75.2	−1.3	97	98.64	−.32	100	100

[7] Stock exchange closed.

TABLE 2.—*Data used in the statistical analysis*—Continued

Year and month	Exports					Miscellaneous data				Derived figures used in the study		
	Pork products				Index of physical volume of exports	Prices of industrial stocks		Bureau of Labor all-commodity index of wholesale prices (1913 base)	United States population monthly	Corn-hog differential	Index of export demand	Index of total demand
	Pork	Bacon	Hams and shoulders	Lard		Actual	Deviation from trend					
1915	*10,000 pounds*	*10,000 pounds*	*10,000 pounds*	*10,000 pounds*	*Million pounds*	*Dols.*	*Per cent*		*Millions*	*Dols.*		
January	355	2,716	1,792	5,770	115	56.6	−1.2	98	98.75	−1.54	101	91
February	463	3,718	1,823	5,862	129	56.0	−1.3	99	98.87	−1.64	101	85
March	428	6,683	2,585	7,215	185	58.3	−1.1	99	98.99	−1.69	101	80
April	880	4,169	1,815	4,486	120	66.4	−.3	99	99.11	−1.63	106	83
May	838	3,360	2,373	2,356	100	66.0	−.3	100	99.22	−1.39	115	91
June	598	4,348	4,001	3,230	138	68.4	−.2	99	99.34	−1.10	119	95
July	620	3,850	2,758	2,275	108	71.9	+.2	100	99.46	−2.07	115	91
August	537	3,758	2,060	2,658	101	79.2	+.9	100	99.58	−2.32	121	90
September	843	4,337	1,776	3,065	111	85.5	+1.5	100	99.70	−1.02	119	94
October	976	5,341	1,945	3,085	126	92.4	+2.1	102	99.82	+.56	130	105
November	1,064	4,588	1,531	3,592	116	94.4	+2.3	104	99.93	−.57	128	99
December	1,520	5,547	2,185	5,075	156	97.0	+2.5	108	100.05	−1.62	126	93
1916												
January	2,237	5,009	2,404	3,672	149	94.7	+2.3	113	100.17	−1.38	99	94
February	1,842	6,381	3,450	4,564	183	93.6	+2.1	115	100.29	−.38	100	104
March	1,436	4,189	2,414	3,958	134	93.3	+2.1	119	100.40	+1.15	112	112
April	1,071	5,344	2,751	4,187	151	89.8	+1.7	121	100.52	+.91	108	114
May	838	5,834	3,147	5,005	168	90.2	+1.7	122	100.64	+1.40	112	123
June	625	3,802	1,800	5,004	125	90.6	+1.7	123	100.76	+1.30	110	124
July	382	3,007	1,505	2,763	86	88.5	+1.5	123	100.88	+.50	113	120
August	509	4,395	1,961	2,445	106	91.0	+1.7	126	100.99	+.49	115	120
September	461	4,922	1,742	3,508	121	97.4	+2.3	130	101.11	+.61	118	118
October	614	4,128	2,555	2,232	109	102.1	+2.7	136	101.23	−1.57	104	106
November	811	4,879	2,416	3,252	129	107.9	+3.3	146	101.35	−1.57	104	105
December	910	7,393	2,571	4,798	178	98.5	+2.3	149	101.47	−.46	106	105
1917												
January	1,378	9,181	2,658	6,723	225	97.2	+2.2	153	101.58	−.19	125	108
February	1,044	5,199	1,947	4,068	138	91.0	+1.7	157	101.70	+1.08	115	110
March	1,286	6,750	2,638	6,112	188	94.6	+1.9	162	101.82	+2.00	146	118
April	1,195	5,731	2,214	4,638	155	93.9	+1.9	173	101.94	−.42	139	112
May	1,106	6,068	2,325	3,221	145	93.4	+1.8	183	102.06	−2.61	127	110
June	638	5,061	2,135	2,476	118	97.0	+2.1	185	102.17	−3.42	111	100
July	415	1,946	1,179	1,010	52	92.9	+1.7	188	102.29	−8.21	93	92
August	519	2,831	1,405	2,374	80	88.6	+1.3	189	102.41	−6.18	115	105
September	529	3,550	1,650	2,217	91	83.6	+.9	187	102.53	−5.68	162	116
October	475	2,936	1,000	993	62	79.0	+.4	183	102.64	−5.82	166	119
November	250	4,357	2,238	3,074	113	71.4	−.3	183	102.76	−6.04	208	130
December	571	4,202	2,951	1,309	105	70.2	−.4	182	102.88	−3.04	200	128
1918												
January	177	5,385	1,649	2,074	107	75.7	+.1	184	102.99	−3.93	200	118
February	221	5,090	2,929	3,194	131	80.0	+.4	186	103.12	−3.29	208	116
March	590	15,560	7,773	6,878	357	78.3	+.3	187	103.24	−2.41	207	114
April	1,048	12,740	9,343	5,445	332	77.6	+.2	190	103.35	−1.79	217	117
May	833	14,201	5,094	8,006	322	80.9	+.5	190	103.47	−.82	227	124
June	352	8,729	4,747	3,102	197	80.6	+.4	191	103.59	−1.54	206	126
July	656	11,989	5,537	7,094	290	81.3	+.5	196	103.71	−1.49	233	136
August	343	6,886	4,582	5,254	195	81.9	+.5	200	103.82	−.51	280	143
September	343	4,154	3,619	3,339	131	82.4	+.5	204	103.94	+2.08	289	138
October	250	5,813	2,543	4,618	150	86.1	+.9	202	104.06	+1.56	237	128
November	294	7,286	2,013	2,734	142	84.4	+.6	203	104.18	+1.94	243	140
December	249	12,644	3,894	3,774	239	82.4	+.5	202	104.30	+.99	265	145
1919												
January	251	10,268	5,485	3,793	231	81.6	+.4	199	104.42	+1.38	275	141
February	317	11,484	4,928	6,913	271	82.0	+.5	193	104.53	+2.80	292	138
March	369	15,109	8,571	9,760	392	87.4	+.9	196	104.65	+2.10	325	139
April	453	14,181	10,957	9,214	402	91.0	+1.3	199	104.77	+1.57	375	142
May	727	6,766	4,910	5,685	206	99.3	+2.0	202	104.88	+.89	388	142
June	1,390	17,244	9,685	11,719	458	105.4	+2.4	203	105.00	−.03	352	138
July	506	11,768	4,745	7,077	276	110.0	+2.9	212	105.12	−.62	259	136
August	413	8,150	4,015	5,108	206	102.6	+2.3	216	105.24	−2.75	203	117
September	394	5,720	1,821	3,841	134	107.7	+2.7	210	105.36	−.79	155	104
October	564	5,646	1,309	4,275	133	114.0	+3.3	211	105.47	−2.31	139	86
November	666	6,529	1,684	4,288	149	110.8	+3.0	217	105.59	−3.26	139	90
December	619	5,898	1,569	6,394	161	105.6	+2.5	223	105.71	−3.74	123	83

TABLE 2.—*Data used in the statistical analysis*—Continued

Year and month	Exports					Miscellaneous data				Derived figures used in the study		
	Pork products				Index of physical volume of exports	Prices of industrial stocks		Bureau of Labor all-commodity index of wholesale prices (1913 base)	United States population monthly	Corn-hog differential	Index of export demand	Index of total demand
	Pork	Bacon	Hams and shoulders	Lard		Actual	Deviation from trend					
1920	*10,000 pounds*	*10,000 pounds*	*10,000 pounds*	*10,000 pounds*	*Million pounds*	*Dols.*	*Per cent*		*Millions*	*Dols.*		
January	661	7, 750	1, 391	3, 942	156	104. 6	+2. 4	233	105. 83	−2. 23	112	83
February	985	7, 589	2, 422	3, 717	168	94. 4	+1. 6	232	105. 95	−2. 14	102	78
March	625	7, 500	3, 109	7. 300	209	99. 6	+2. 0	234	106. 06	−3. 62	97	75
April	390	2, 436	1, 564	4. 370	97	100. 8	+2. 1	245	106. 18	−5. 36	97	69
May	576	5, 041	1, 790	6, 014	150	91. 4	+1. 3	247	106. 30	−9. 18	98	68
June	815	6, 073	2, 128	4, 717	155	91. 4	+1. 3	243	106. 42	−7. 23	100	70
July	527	3, 152	839	4, 894	103	90. 6	+1. 2	241	106. 54	−4. 00	100	70
August	281	2, 333	936	3, 220	75	85. 4	+. 8	231	106. 66	−3. 14	102	74
September	390	4, 137	900	4, 820	114	87. 0	+. 9	226	106. 77	−. 10	97	78
October	863	4, 984	879	5, 585	136	84. 9	+. 7	211	106. 89	+2. 74	100	77
November	516	5, 793	1, 120	5, 841	148	78. 4	+. 1	196	107. 01	+2. 75	101	76
December	1, 253	6, 878	1, 449	9, 129	206	71. 9	−. 4	179	107. 13	+. 49	101	66
1921												
January	2, 181	4, 320	1, 687	7, 981	176	75. 1	−. 1	170	107. 24	+1. 14	107	65
February	919	3, 164	1, 585	9, 468	164	75. 5	−. 1	160	107. 36	+1. 56	113	66
March	495	3, 535	1, 910	8, 368	157	75. 4	−. 1	155	107. 48	+2. 29	113	69
April	598	3, 285	2, 493	5, 444	132	76. 7	. 0	148	107. 60	+1. 63	111	62
May	576	3, 846	1, 551	5, 131	123	77. 2	+. 1	145	107. 72	+1. 01	109	65
June	547	3, 501	1, 854	6, 989	142	69. 1	−. 6	142	107. 84	+1. 02	106	66
July	1, 080	4, 817	2, 779	8, 480	189	68. 5	−. 7	141	107. 95	+2. 53	101	75
August	732	4, 534	3, 223	9, 003	193	66. 8	−. 8	142	108. 07	+2. 64	99	71
September	460	4, 472	1, 714	10, 753	189	70. 2	−. 5	141	108. 19	+1. 35	98	56
October	540	2, 360	1, 211	5, 807	108	71. 3	−. 5	142	108. 31	+2. 15	97	57
November	522	1, 564	1, 678	5, 259	99	76. 0	. 0	141	108. 42	+1. 20	99	57
December	355	2, 136	1, 548	6, 606	116	79. 9	+. 3	140	108. 54	+1. 15	100	58
1922												
January	502	2, 611	2, 201	7, 447	140	80. 9	+. 4	138	108. 66	+2. 20	99	66
February	395	3, 079	2, 521	7, 809	152	84. 0	+. 7	141	108. 78	+3. 09	96	76
March	401	3, 118	2, 358	6, 563	137	87. 3	+. 9	142	108. 90	+3. 46	92	77
April	314	2, 049	2, 276	4, 373	100	91. 7	+1. 3	143	109. 02	+3. 41	92	76
May	339	1, 907	2, 499	5, 199	110	93. 6	+1. 5	148	109. 13	+3. 17	95	77
June	528	2, 407	3, 155	5, 896	133	93. 4	+1. 5	150	109. 25	+3. 02	97	79
July	593	3, 258	2, 667	6, 825	148	95. 2	+1. 6	155	109. 37	+2. 09	99	72
August	571	3, 259	1, 876	7, 060	140	98. 3	+1. 9	155	109. 49	+ . 96	99	64
September	637	3, 045	2, 059	6, 272	132	99. 8	+2. 0	153	109. 60	+1. 19	103	70
October	668	2, 885	2, 209	6, 809	138	100. 4	+2. 1	154	109. 72	+. 72	109	76
November	937	2, 617	2, 524	6, 390	137	95. 8	+1. 7	156	109. 84	−. 32	117	75
December	919	3, 949	2, 616	8, 111	172	97. 6	+1. 8	156	109. 96	−. 45	119	78
1923												
January	1, 055	4, 335	3, 108	11, 116	215	97. 9	+. 66	156	110. 08	−. 01	120	80
February	772	3, 630	2, 819	9, 154	180	101. 8	+. 95	157	110. 20	−. 49	119	75
March	662	4, 055	2, 589	11, 214	202	104. 3	+1. 14	159	110. 32	−. 42	120	74
April	716	3, 479	3, 374	8, 860	181	101. 5	+. 93	159	110. 43	−1. 22	120	74
May	532	3, 452	3, 003	9, 534	181	96. 2	+. 53	156	110. 55	−1. 90	124	76
June	652	2, 864	3, 075	6, 579	146	93. 7	+. 35	153	110. 67	−2. 65	125	74
July	711	2, 758	3, 668	7, 029	157	89. 3	+. 01	151	110. 78	−2. 87	125	78
August	869	3, 300	3, 619	8, 508	180	90. 8	+. 13	150	110. 90	−2. 25	128	88
September	855	4, 516	3, 175	8, 519	189	90. 3	+. 09	154	111. 02	−1. 66	128	92
October	817	4, 669	2, 565	7, 765	175	87. 7	−. 11	153	111. 14	−4. 35	126	89
November	1, 094	3, 903	3, 292	7, 602	176	91. 0	+. 14	152	111. 26	−3. 69	128	93
December	1, 172	4, 713	2, 913	10, 071	207	94. 1	+. 37	151	111, 38	−1. 31	128	84
1924												
January	944	4, 601	3, 305	13, 615	244	97. 4	+. 62	151	111. 49	−1. 56	128	92
February	718	4, 377	3, 734	10, 240	210	98. 8	+. 73	152	111. 62	−2. 07	124	86
March	577	3, 400	3, 269	10, 296	192	96. 3	+. 53	150	111. 73	−1. 73	117	84
April	468	2, 953	2, 801	7, 535	152	91. 7	+. 19	148	111. 85	−1. 60	113	82
May	369	1, 694	2, 864	6, 548	126	90. 5	+. 10	147	111. 96	−1. 56	111	85
June	336	1, 465	2, 950	6, 231	121	92. 6	+. 26	145	112. 08	−2. 22	107	90
July	441	2, 379	2, 997	8, 915	161	98. 3	+. 68	147	112. 20	−4. 30	101	99
August	498	2, 649	2, 588	7, 774	148	103. 3	+1. 06	150	112. 32	−3. 66	99	113
September	427	2, 445	1, 866	6, 727	125	102. 8	+1. 02	149	112. 44	−3. 52	95	105
October	447	2, 284	2, 252	6, 211	123	102. 0	+. 96	152	112. 56	−2. 06	94	111
November	474	1, 520	2, 023	5, 156	101	108. 2	+1. 42	153	112. 67	−3. 34	94	102
December	739	1, 641	1, 738	7, 943	130	114. 2	+1. 88	157	112. 79	−3. 95	96	103

TABLE 2.—*Data used in the statistical analysis*—Continued

Year and month	Exports					Miscellaneous data				Derived figures used in the study		
	Pork products				Index of physical volume of exports	Prices of industrial stocks		Bureau of Labor all-commodity index of wholesale prices (1913 base)	United States population monthly	Corn-hog differential	Index of export demand	Index of total demand
	Pork	Bacon	Hams and shoulders	Lard		Actual	Deviation from trend					
1925	*10,000 pounds*	*10,000 pounds*	*10,000 pounds*	*10,000 pounds*	*Million pounds*	*Dols.*	*Per cent*		*Millions*	*Dols.*		
January	751	2, 480	3, 137	8, 055	158	122. 2	+2. 47	160	112. 91	−4. 14	92	97
February	519	2, 020	2, 784	6, 148	127	121. 1	+2. 39	161	113. 03	−3. 47	89	96
March	532	2, 268	3, 117	6, 425	137	120. 9	+2. 38	161	113. 14	+. 04	108	110
April	378	1, 296	2, 045	4, 602	92	119. 8	+2. 29	156	113. 26	+. 13	95	101
May	319	1, 255	2, 092	7, 241	118	126. 1	+2. 76	155	113. 38	−1. 33	91	97
June	326	1, 388	2, 581	6, 119	114	128. 8	+2. 97	157	113. 50	−. 42	89	94
July	286	1, 416	2, 132	5, 164	99	136. 6	+3. 32	160	113. 62	+1. 15	-------	-------
August	387	1, 443	1, 734	4, 759	91	139. 6	+3. 78	160	113. 74	+1. 23	-------	-------
September	485	1, 766	1, 524	6, 241	109	144. 0	+4. 10	160	113. 85	+2. 54	-------	-------
October	404	1, 541	1, 529	4, 657	89	149. 9	+4. 54	158	113. 97	+2. 10	-------	-------
November	381	1, 466	1, 703	4, 092	84	153. 9	+4. 84	158	114. 09	+1. 66	-------	-------
December	430	1, 819	2, 209	7, 067	126	154. 2	+4. 86	156	114. 21	+1. 50	-------	-------

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